VOLUME 19 / NUMBER 12
JUNE 23, 1981
ACC. NOS. N81-21008 TO N81-21997

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 19, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by PRC Data Services Company.

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US ISSN 0036-8741

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1703
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1703
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see 61 Computer Programming and Software.

83 ECONOMICS AND COST ANALYSIS 1707
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1707
Includes applications of space technology to urban problems; technology transfer; technology assess*ment; and surface and mass transportation.*
For related information see *03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1708
Includes radio and gamma-ray astronomy; celestial *mechanics; and astrometry.*

90 ASTROPHYSICS 1708
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1708
Includes planetology; and manned and unmanned flights.
For spacecraft design see 18 Spacecraft Design, Testing and Performance. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1709
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer *earth's radiation belts.*
For biological effects of radiation see *52 Aerospace Medicine*. *For theory see 73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1710

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
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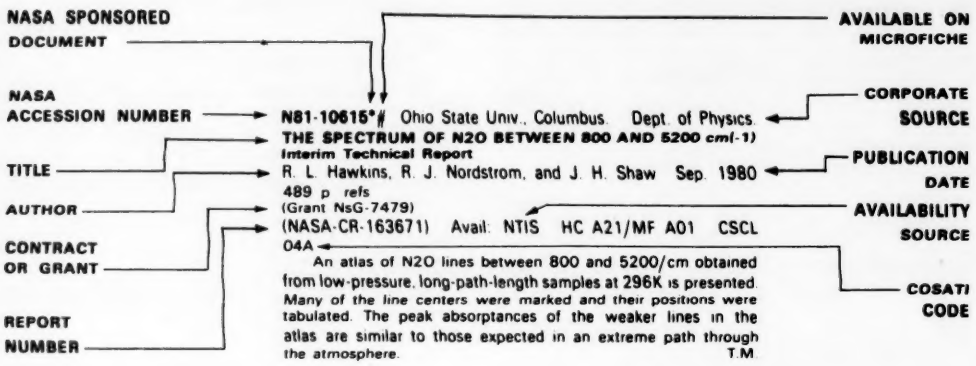
TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
PUBLICATION DATE
AUTHOR
489 p refs
(Grant NsG-7479)
AVAILABILITY SOURCE
CONTRACT OR GRANT
(NASA-CR-163671) Avail: NTIS HC A21/MF A01 CSCL 04A
COSATI CODE
REPORT NUMBER
An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere.
T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, IMPROVED SURGE MARGIN CENTRIFUGAL COMPRESSOR

R. Clarke, Signal Co. Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0D3999; DAAJ02-75-C-0033)

The objective is to investigate experimentally the factors critical to centrifugal compressor flow range, surge, and efficiency flow characteristics, and subsequently, to demonstrate a single-stage, high-pressure-ratio centrifugal compressor having peak performance on or near a projected engine operating line. Achievement will result in approximately a four-point improvement over current operating line efficiency with a predicted 6-8 percent reduction in fuel consumption and its attendant potential for increased range and/or payload for future Army helicopters.

Design a baseline 10-1 pressure ratio compressor having a geometry favorable to broad flow range and a number of modifications thereof varying geometrical/aero factors critical to flow range and efficiency. Fabricate, test and analyze data to formulate design correlations for the critical factors. Use the correlations to design, fabricate and test an optimum compressor stage.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0002, DESIGN CRITERIA FOR INCREASED ENERGY ABSORBER EFFECTIVENESS (DA0E3873)

S. Desjardins, Simula Inc., *2223 S. 48th St., Tempe, Arizona* 85282 (DA0G0076; DAAK51 79 C 0026)

Objective is to formulate crash energy-absorber design criteria for more effective use of available seat stroking distance, thereby reducing the probability of occupant injury due to vertical decelerative loading.

Effects of energy-absorber parametric variations on seat occupant dynamic response will be determined by test and analysis. Major portions of the dynamic crash testing will be performed by the FAA Civil Aeromedical Institute and the Naval Air Development Center. Recommended revisions to existing crashworthy seat energy-absorber design and test criteria will be proposed.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0003, RESEARCH OF TUTORIAL CAPABILITY FOR THE USE OF LARGE STRUCTURAL ANALYSIS SYSTEMS

R.J. Melosh, Marc Analysis Research Corp., *260 Sheridan Ave., Suite 314, Palo Alto, California* 94306 (DF133220; F33615-78-C-3206)

The use of finite element analysis for the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. The effective use of large structural analysis systems requires the user to devote a considerable effort and long calendar time to become familiar with its capabilities or consult some person who is an expert in its utilization. The objective of this effort is to explore the possibility of creating an expert consultant by utilizing the capabilities of a computer. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for present and future aerospace systems, such as F-16, A-10, and YC-15 with a minimum analysis time.

A literature search has revealed that significant advances have been made in other scientific fields in using the methodology of production systems to create an expert consultant. The ideas of production systems will be utilized to investigate the possibility of creating an expert consultant for the use of large structural analysis systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS

J.B. Chang, Rockwell International Corp., *International Airport, Los Angeles, California* (DF140670; F33615-77-C-3121)

MIL-A-83444 and MIL-A-8866B both require the capability to predict the effects of spectrum loading on aircraft safety and durability. The impact of these effects on such design parameters as cost, weight, material and configuration must be assessed at the earliest possible phase of the aircraft design cycle. Current state-of-the-art techniques involve detailed cycle-by-cycle analysis of complex flight-by-flight load histories. These analyses are time consuming and sophisticated, making them unsuitable for use in the preliminary design stage and very expensive to use for the detailed analysis stages. The objective of this effort is twofold - (1) develop more efficient and economical models for characterizing spectrum effects and (2) develop techniques for implementing the specifications at the preliminary design stage. Accomplishment of these objectives will permit economical, efficient application of safety and durability criteria throughout the life cycle of USAF aircraft.

A large experimental data base exists relative to spectrum loading effects on crack growth. The approach will be to assess this data base to isolate the significant parameters which characterize the spectrum effects at various levels of analysis such as preliminary design, force management, and detailed failure analysis. Methodology will be developed to relate the spectrum effects to damage accumulation. Emphasis will be placed on development of handbook methods as well as computer programs. Results will be incorporated in the USAF Damage Tolerant Design handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, FORWARD SWEPT WING AERODYNAMIC SENSITIVITIES

Unknown, Rockwell International Corp., *International Airport, Los Angeles, California* (DF144970; F33615-80-C-3010)

The Air Force function for this effort is to study the effects of canard geometry and location, boundary layer fences and various wing-tip shapes on the aerodynamic characteristics of forward swept wings. The problem has been that there is insufficient data available to provide guidelines on the proper design and location of these various components affecting the perform-

ance of the wings. The objective of this effort is to test a parametric research model to determine the changes in the wing aerodynamic characteristics while the canard, fences and tip sizes and locations are varied. Data will be analyzed and the aerodynamic sensitivities highlighted. Benefit for the Air Force comes from the development of guidelines on the proper sizing and location of these components affecting the wing performance.

A half span model with capabilities for various canard sizes and location, wing-tip shapes, boundary layer fences and fuselage contours will be designed, fabricated and tested. Force and pressure measurements will be conducted at various Mach numbers and angles of attack.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, F100 NON-RECOVERABLE STALL INVESTIGATION

S. Rock, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF463970; F33615-79-C-2048)

To investigate the F-100 non-recoverable stall phenomena and to develop working models that will duplicate the engine signature during non-recoverable stall.

Existing data from AEDC shall be analyzed for information content, data quality. Analytical models shall be developed from existing engine simulations and AEDC stall data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0007, ROTOR ACOUSTIC RESEARCH

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0C5003)

The rotor aerodynamically-generated noise signature cannot be calculated by the present technology. The newly developed in-flight noise measurement technique has provided for the first time full-scale rotor noise measurements undistorted by reverberation Doppler shift and other normal prevalant signal distortion mechanisms. Fortunatley these sound pressure levels have been shown to be reproducable with model rotors in the Aeromechanics Laboratory unique acoustic rotor test system. The objective of this program is to maximize the benefits of this fortunate situation by utilizing the controlled environment of the acoustic hover facility in an effort to try to understand how this aerodynamic noise is generated and radiated thru the application of holographic techniques. If successful these research efforts should provide the understanding of the noise generation mechanisms necessary to develop mathematics analysis which can be used for rotor noise source and radiation pattern prediction.

A combined experimental theoretical effort will be followed. A laser holographic system will be developed and utilized to obtain visual pictures of the density gradients created by the disturbance of the rotor blade and by sequencing of the pictures determine how the wave eminents from the blade coalesce into a shock wave and propagate to the far-field. Previous theoretical work has obviously neglected the disturbance field created off the rotor blade surfaces. By proper accounting and representation of these transonic disturbance fields significant improvements in predictive capabilities can be expected.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0008, EFFECT OF PRETRAINING CRITERION ON SECONDARY COGNITIVE TASK PERFORMANCE DURING AIRCRAFT FLIGHT SIMULATION

M. Nataupsky, U.S. Dept. of Defense, Air Force, Air Force Academy, Behavioral Science & Leadership Dept., *Colorado Springs, Colorado* 80840 (DF282360)

AF function - technology base. Deficiency - effect of criterion level on cognitive tasks with aircraft flight simulation is not available. Objective - the purpose of this study is to investigate the effect of training criteria on performance in a flight simulator and on a secondary cognitive task. How work contributes - if successful, this study vill open a line of research on the effect of criterion level in flight simulation research. It will also ask for a re-evaluation of some previous flight simulation research in which no differences in treatment effects were found.

A total of 28 USAFA cadets will be trained to fly the vertical-S 'A' in a GAT-1 simulator. Half of the cadets will be trained to fly with the criterion of plus/minus 5 degrees from the desired heading. The other half will be trained to fly with the criterion of plus/minus 10 degrees from the desired heading. Subsequent to the initial training, all cadets will have test trials with the addition of difficulty levels of a secondary cognitive task. All cadets will also have a test trial with no secondary cognitive task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

1.0009, FAILURE PROCESSES IN ADVANCED COMPOSITE STRUCTURES

L.W. Rehfield, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF052760; F49620-78-C-0085)

AF function - future high-performance aerospace vehicles will require improved structural efficiencies and increased durability. Deficiency - insufficient knowledge is available regarding the fracture of advanced composites and adhesive joints and their durability under environmental exposure. Objective - the objective of the research is to delineate the basic fracture behavior of advanced composites and adhesive joints and to understand the environmental degradation of their dynamic characteristics in both laminates and innovative structural configurations. How work contributes - research results will advance the state-of-the-art regarding the application of advanced composites to aircraft and missile primary structure.

Fracture processes and stability of advanced composite laminates and adhesively bonded joints will be investigated using hybrid finite element methods. Modeling of this process will be done at several levels, first, considering only the constrained matrix material, second, considering a unidirectional composite, i.e., matrix/fiber interaction, third, multidirectional laminates. Both mode I and mixed-mode fracture will be studied. Degradation of advanced composite dynamic properties will be studied experimentally, based on elevated temperature and high humidity environments. Reversible and irreversible changes in damping and stiffness characteristics will be investigated for a number of typical laminate geometries.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0010, SELF-CONTAINED CARTRIDGE FOR ADVANCED EJECTOR SYSTEMS

A.J. Kapinos, U.S. Dept. of Defense, Navy, Naval Ordnance Station, *Indian Head, Maryland* 20640 (DN896203)

To investigate self-contained cartridge concepts and apply the resulting technology to advanced ejector systems. The objective is to decrease stores release/ejection equipment maintenance and thus reduce aircraft turn-around time and increase aircraft operational readiness.

A self-contained cartridge design is being investigated which will encapsulate all propellant combustion products. This will provide a totally clean power source for stores release/ejection equipment. The cartridges are being tested in a breadboard ejector system. Based upon propellant requirements established in FY 79, a candidate propellant system was selected for evaluation (formation of a high percentage of condensibles resulting in low residual cartridge pressure) which was conducted in FY 80. Also, cartridge case optimization is being pursued to achieve the desired performance objective goals. In FY 81, all-up feasibility demonstration of the self-contained cartridge and propellant design will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0011, HELICOPTER IR RADIATION PREDICTION (SPRITE, MOD)

B. Wilton, General Electric Co., Aircraft Engine Group, *1000 Western Ave., Lynn, Massachusetts* 01901 (DA0E3866; DAAK51 79 C 0012)

Improvement of Army's spectral plume radiation intensity target evaluation (SPRITE) computer program to include helicopter aircraft modeling, missile lock-on range, and more efficient computer predictions.

SPRITE will be expanded to provide helicopter airframe modeling and missile lock-on range predictions. The hot-metal prediction modules will be revised to provide more efficient programing and computer core time.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0012, SELF-CONTAINED LANDING SYSTEM

S.B. Waldman, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Air Traffic Management Systems Div., *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0G2425)

Develop a self-contained (totally airborne) landing system which will provide Army helicopters with the capability of making decelerated steep instrument approaches to a hover into unprepared tactical sites. The landing system must be usable in IMC in which visibility and ceiling are both virtually zero. Identification of the landing site, selection of a safe approach path, and guidance down the safe descent path must be accomplished without prior placement of equipment at the landing site by ground personnel and without any assistance from ground personnel.

Award a contract for an investigation of available sensors and system approaches. Analyze report for promising solutions. Award contract for self-contained landing system design plans. Select most promising system design concept, and award contract for self-contained landing system exploratory development model equipment. Conduct flight tests and improve model through iterative testing and modifications.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0013, INTEGRAL COMPOSITE SKIN AND SPAR DESIGN STUDIES

C.M. Cacho Negrete, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF141750; F33615-78-C-3209)

Advanced composite structures are beginning to be used in production military aircraft airframes since they offer a large potential for weight and cost savings. The amount of payoff realized by the use of composites will depend upon the efficiency of the design concepts used. A new concept dealing with integral composite skin and spars has a good potential for increasing the efficiency of composite wing structures. Therefore, the objective of this program is to obtain extensive design information on various integral skin and spar concepts so that these designs may be incorporated into future aircraft.

This effort will develop design data for several integral composite skin and spar concepts. An existing fighter aircraft will be used as a baseline, and new concepts will be developed to meet the specific requirements of this baseline. Activities to be conducted include preliminary design, detailed design and analysis, test specimen construction and extensive environmental testing under several loading conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, ACOUSTIC EMISSION MONITORING OF FATIGUE CRACKING IN FULL-SCALE AIRCRAFT

C. Hurak, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890168; N00019-79-C-0218)

Investigate the feasibility of acoustic emission monitoring for real-time detection and location of fatigue crack initiation and growth in full-scale aircraft structure.

Acoustic emission monitoring systems, combining noise discrimination and frequency analysis concepts, will be used to detect and locate fatigue cracking in a high extraneous noise environment of a full-scale aircraft fatigue test.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0015, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION SYSTEM CONCEPTS FOR NAVY AIRCRAFT - ROTAC DESIGN

J. Leonard, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN081445; N62269-79-C-0266)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in on-board computers, electrical power equipment and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. This contract supports work unit ZA601, agency accession no. DN681080.

An invesestigation will be conducted to determine feasibility of integrating an all electric rotary actuator in a proposed aircraft. The investigation will determine potential benefits and design concepts for mechanization of such a system. A follow-on program may include development of hardware, testing and eventual flight demonstration.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0016, FORMULATION OF STOL CONFIGURATIONS

Unknown, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF143360; F33615-79-C-3007)

The Air Force function for this effort is to investigate advanced STOL configurations. STOL configurations represent an opportunity for a solution to the runway denial problem which has high Air Force interest. The objective of this effort is to develop advanced conceptual fighter designs that incorporate STOL configurations and other advanced technologies. The contribution of advanced STOL configurations is short take-off and landing from damaged runways or even highways, enhanced maneuvering performance, improved survivability, and improved target kill capability.

Parametric tradeoff studies will be conducted for each stol configuration to define the baseline configuration geometries and optimize gross take-off weights. Based on the tradeoff studies and technology expected to be available between 1982 and 1985, six baseline STOL configurations will be developed, including two configurations using vectored-engine-over-wing propulsive lift. A performance analysis will be conducted for each STOL configuration and a comparison of advantages/disadvantages of the STOL configuration for each application will be made. The most promising STOL configuration for each application will be determined and the performance and operational benefits of STOL configurations will be identified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, MULTI-PLANE HIGH SPEED BALANCING OF FLEXIBLE ROTOR

Unknown, Teledyne CAE, *1330 Laskey Rd., Toledo, Ohio* 43612 (DF463490; F33615-79-C-2018)

The objective of this program is to demonstrate the feasibility of applying a multi-plane high speed balance to a low pressure (LP) rotor assembly from a limited life two-spool turbofan engine. The LP rotor assembly will be balanced in an evacuated balancing rig and operated above its fourth critical speed.

The LP shaft assembly from the 471-11DX cruise missile engine will be modified by removing the intershaft bearings and using a solid shaft instead of the current hollow shaft. This

modification will cause the fourth critical speed to be in the operating range.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0018, APPLICATION OF CATALYTIC COMBUSTION TO GAS TURBINE ENGINES

T.J. Rosfjord, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458230)

The objective of this work unit is to investigate the application of catalytic combustion to the primary combustor and afterburner of gas turbine engines. Goals of improved combustion performance and low exhaust emissions over the entire operational range of these components will be pursued.

Each of the four efforts described above is a small part of much larger projects being carried out in Room 20 and the J85 engine test. Projects 30480542 and 30660532 describe the operation of these facilities while other technical work is described in 30480569, 30480570, 30480571, and 30480526. Objectives of the subject testing have been selected to require minimum data acquisition time while technical orientation is towards specific problems, opportunities, or questions. Each effort will require approximately two weeks of test time and will result in a technical report or paper. A coordinated plan has been established with NASA Lewis Research Center in this technical area, which allows AFAPL to maintain cognizance of the important results of their substantial effort while allowing rapid dissemination of AFAPL-generated knowledge.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0019, SURVIVABLE AIRCRAFT TRANSPARENT ENCLOSURES

R.E. McCarty, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140230)

This work unit supports the development of USAF aircraft transparent crew enclosures able to survive anticipated operational hazards including bird-strike, aerodynamically induced thermal loads, and exposure to the environment and to routine maintenance procedures. Losses of aircraft and aircrew from transparency birdstrike events remain unacceptably high, transparent materials capable of withstanding the thermal loads imposed by next-generation USAF aircraft are available, and serious differences continue to exist between transparency performance predicted on the basis of current test methods and that experienced in operation. The objectives of this work unit are the application of a computer program for the design of bird resistant transparencies, high temperature criteria development for transparency materials, and definition of aircraft transparency testing requirements. The computer program analyses will improve aircraft/aircrew survivability, the high temperature criteria studies will increase the operational capabilities of USAF aircraft, and the testing requirements studies may lead to the development of new test methods which will significantly reduce costs associated with the reliability of transparency systems.

A previously developed computer program will be utilized to do correlation studies of B-1 aircraft windshield birdstrike. Existing birdstrike test data will be utilized and a technical report will document the correlation obtained between data and computed results. The high temperature criteria work will include the development of a computer program for first-order aerothermodynamic analysis of supersonic aircraft windshields. The transparency test requirements work will include a literature search, an analysis to develop testing requirements for current and future USAF aircraft transparencies, and a survey to establish existing transparency test capabilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, PROPULSION TECHNOLOGY

C.L. Walker, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Propulsion Lab., *21000 Brookpark Rd., M/S 77-5, Cleveland, Ohio* 44135 (DA0E3534)

Implement research and development program for advanced propulsion and drive train components relevant to current and potential future Army aircraft application. Provide the technology base for evaluation of concepts for improvement and application including considerations for related needs in fabricational techniques.

In joint participation with NASA-Lewis Research Center, conduct analyses, element design, fabrication, tests, and breadboard hardware evaluation of advanced propulsion and drive train concepts. Work is jointly conducted with NASA using their facilities with emphasis on turboshaft engine technology including compressor, turbine, combustor and the resulting requirements on seals, shafting, bearings, gears, and material.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Propulsion Lab.

1.0021, INVESTIGATION OF OPERATIONAL AND DESIGN FACTORS RESULTING FROM MAIN ROTOR AND TAIL ROTOR INTERACTION

P. Sheridan, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G3294; DAAK51-80-C-0025)

To understand aerodynamic interaction between helicopter main rotor and tail rotor in low-speed (NOE) flight regime.

Effort will consist of conducting an experimental investigation on scaled helicopter model to obtain flow interaction and performance data.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, CRASHWORTHINESS DESIGN PARAMETER SENSITIVITY ANALYSIS

A.E. Tanner, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G0419; DAAK51-79-C-0042)

Minimize the adverse impact of crashworthiness design criteria on the cost, weight and performance of future Army helicopter designs and identify R&D efforts required to reduce the cost and weight associated with crashworthiness requirements.

The work to be performed under this procurement shall investigate the effect of MIL-STD-1290 crashworthiness requirements on future light helicopters. Both metal and composite airframe structures shall be investigated. Trend data shall be developed for crashworthiness cost and weight as a function of helicopter weight and as a function of the level of crashworthiness specified. Crashworthiness cost drivers are to be identified to assist in determining future R&D efforts necessary to reduce the cost of incorporating crashworthiness into future helicopter designs without reducing the level of crash impact protection from that specified in MIL-STD-1290.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0023, BLOCK PROGRAM PERSONNEL PROTECTION AND SURVIVAL

D.N. Desimone, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN681085)

To provide Navy aircrew personnel with the operational capability to perform aircrew tasks with maximum efficiency. The continuing improvement in air-borne weapons systems demands increased skills from the crew, and increases the potential hazards resulting from the enhanced aircraft performance envelope. Because of this continuing improvement in aircraft performance capability, there is a continuing need to advance aircrew protection.

Development efforts to meet the primary objectives include the experimental development of or search for new materials, components, techniques of fabrication, subsystems and systems. Efforts will vary from the fundamental to the sophisticated application of the principles of engineering and physiology.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

1.0024, FUEL MICROEMULSIONS FOR JET ENGINE SMOKE REDUCTION

C. Moses, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DF336840; F08635-79-C-0213)

The U.S. Air Force has an operational and environmental requirement for using smokeless high efficiency aircraft gas turbine engines. This work unit will determine the feasibility of synthesizing JP-4 fuel/water and fuel/alcohol microemulsions and demonstrate their capacity for reducing smoke and increasing combustion efficiency in an actual gas turbine combustion system. Microemulsion synergism with smoke suppressant fuel additives will also be explored. Positive results could lead to an inexpensive uncomplicated way to meet jet engine test cell air pollution regulations, improve gas turbine engine fuel economy, and improve the fire safe qualities of Air Force jet fuels.

This work unit is a multi-source procurement using lab directors funds. Task I will determine whether JP-4/water and JP-4/alcohol microemulsions can be created. Task II will demonstrate the effects of microemulsions on gas turbine combustor emissions (smoke, NOX, HC, CO) and performance. Fuel microemulsions with smoke suppressant additives will also be examined. Task III will include further combustor rig testing to determine the limits of the water/alcohol/additive concentration versus smoke reduction.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

1.0025, EJECTOR WING DESIGNS

J. Porter, Vought Corp., Aeronautics Division, *P.O. Box 5907, Dallas, Texas* 75222 (DF143740; F33615-79-C-3017)

The design of innovative aircraft is an important function of the Air Force. Deficiency in the present design methods is such that only certain refinements to the conventional configurations can be made in order to fulfill the mission requirements. The objective of this effort is to develop new designs such as an ejector-wing which provide significantly advantageous lift and thrust augmentations. This will provide the Air Force with aircraft that can be energy saving and maneuverable in the low flight speeds.

Ejector wing configurations will be developed by means of a compressible flow analysis so that optimized propulsive and aerodynamic characteristics are achieved. On the basis of the theoretical data, a test model will be fabricated and tested in a wind tunnel for validating the concept.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, RESEARCH IN AERODYNAMICS

J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Research & Technology Lab., *Hampton, Virginia* 23665 (DA0E3553)

To conduct basic and applied research to develop or improve analytical techniques, prediction techniques, measurement techniques, and design data related to rotary wing airfoil development, unsteady aerodynamic phenomena, rotor wake characteristics, tip vortex generation and propagation, and rotor performance investigations are selected based on continual review of the Army's aviation objectives and assessment of those fundamental technology shortcomings which would prevent or restrict achievement of these objectives.

In joint participation with NASA, analytical and experimental programs will be conducted to develop rotor airfoils which are based on mission profiles and empirically-derived environments. Unsteady experimental and analytical research will be conducted to develop an understanding of and the capability to analyze and predict rotor unsteady aerodynamic characteristics. Experimental programs will be conducted to quantify rotor wakes; to develop methods for drag reduction; and to determine rotor performance, acoustics, and interference effects.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0027, AEROELASTIC STABILITY OF FORWARD SWEPT WINGS

T.A. Weisshaar, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace & Ocean Engineering, *Blacksburg, Virginia* 24061 (DF144400; F33615-79-C-3224)

Recent studies have indicated that forward swept wings show improvements in transonic performance when compared to conventional aircraft. Sweeping metal wings forward increases flutter speed but decreases divergence speed, but by using aeroelastic tailoring of advanced composites the forward swept wing can be designed with higher divergence speeds. A computer procedure used to perform parameter studies of composite forward swept wings was developed under a previous effort. Under this effort, the computer program will be expanded to include a flutter analysis capability, then several parameter studies will be done to fully document the effect of composite tailoring on static aeroelastic and flutter of forward swept wings.

This is a three-phase effort. During Phase I, the computer procedure will be expanded to include flutter analysis capabilities. In Phase II, parameter studies related to wing/store flutter will be performed. And in Phase III, static aeroelastic studies and computer program documentation will be performed. A technical report, computer program and user's manual will be the end products of this effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, SUPERSONIC WING-BODY ANALYSIS AND DESIGN

P.E. Rubbert, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139590; F33615-77-C-3051)

This work will be in support of designing and analyzing fighter aircraft becoming operational in the 1985 time frame. Many of these aircraft have geometrical shapes that present considerable difficulty in estimating aerodynamic properties. This includes calculations of the flow in and around the region of the engine inlet and over a highly blended wing/fuselage/inlet shape typical of advanced supersonic fighters. This effort will allow the aerodynamic properties of a vehicle to be estimated without running tunnel tests on impractical shapes. This will represent a substantial cost saving to the Air Force and will result in a computer program capable of computing the flow over highly complex aircraft shapes at supersonic speeds.

An advanced paneling method will be used to describe the aircraft to a computer program. This technique can be used to calculate the three-dimensional flow field about a complete aircraft. It is also amenable to the computation of internal flows such as ducts, inlets, and wind tunnels. This method will make use of source and doublet panels as the basic building blocks for geometrically describing the aircraft configuration. Output data would consist of pressures and velocities at all boundary points, three component forces and moments, and streamlines both on the aircraft and in the flow field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, NEW POLYMERS FOR USE AS DETECTORS, SENSORS, OR ELECTRONIC COMPONENTS

C.U. Pittman, University of Alabama, School of Arts & Sciences, Dept. of Chemistry, *Box 1937, University, Alabama* 35486 (DN323144; N00014-75-C-0689)

The Navy has an interest in materials with electrical and catalytic properties that can be exploited for use as detectors, sensors or general electronic components. It is proposed to prepare and to study the properties of polymeric materials which include metals and which have highly anisotropic properties. This combination will provide enhanced catalytic activity, conductivity, piezoelectric, pyroelectric or ferroelectric properties.

Transition metal carbonyls will be incorporated into a polymeric system, then cross-linked, and finally pyrolyzed to pro-

duce materials with free metal atoms in organic matrices. Metallocene polymers will be prepared and oxidized and coupled to donor or acceptor substrates. Polymers will be produced containing transition metals in mixed valence states along with charge-transfer sites. The relative catalytic activity of polymer-bound catalysts will also be examined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, THE THERMODYNAMIC AND REACTION PROPERTIES OF NONMETALLIC SOLIDS HAVING EXTENDED DEFECTS

L. Eyring, Arizona State University, School of Liberal Arts, Dept. of Chemistry, *Tempe, Arizona* 85281 (DMR78-05722)

Some oxides, such as those of terbium and praesodymium, form homologous series of ordered intermediate phases, R_nO_{2n-2}, with narrow composition range. Also formed are nonstoichiometric phases of wide composition range. Chemical hysteresis is shown in all two-phase regions. Furthermore, the oxides are fluorite related in common with a large group of materials, including many of technical significance. In the present work, several of the terbium and praesodymium oxide phases are studied. Thermodynamic data for the phase stability and hysteresis are determined by thermogravimetric, tensiometric, X-ray diffraction, and microcalorimetric methods. The kinetics of the phase transitions, which involve oxidation or reduction, are determined for powders and selected single crystals using the first three of these methods. The kinetic data are interpreted theoretically.

This is a continuation of work supported by DMR 75-05956. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0003, MOLECULAR RELAXATION AND COHERENT TRANSIENT EFFECTS

R.L. Shoemaker, University of Arizona, Graduate School, Dept. of Optical Sciences, *Tucson, Arizona* 85721 (CHE78-24085)

This research is in the area of quantum chemistry; it deals with laser spectroscopy. Dr. Shoemaker plans to carry out a program of research on coherent transient effects and their use as a probe to study fast relaxation processes in gases. To observe and study the transients, both frequency and Stark switching will be used. A major thrust of the research will be to further improve a frequency switched CO_2 laser which he has successfully developed and to use it to study relaxation in several important molecular gases such as CO_2, SF_6, and D_2O. Two other studies will involve experiments which are aimed at improving the understanding of velocity changing collisions within a Doppler-broadened line and at learning more about the velocity dependence of various relaxation processes. In addition he plans to try several new coherent transient techniques which may allow one to make improved relaxation measurements in the future. Finally, theoretical work will be done in conjunction with his research involving adiabatic rapid passage and multiple pulse echoes in order to help determine exactly what quantities are being measured in these experiments.

This research represents a continuation of that currently supported by Foundation grant CHE7517834.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, FABRICABLE POLYMERS WITH EXCELLENT HEAT, OXIDATIVE AND HYDROLYTIC STABILITY *(16232-C)*

C.S. Marvel, University of Arizona, School of Liberal Arts, Dept. of Chemistry, *Tucson, Arizona* 85721 *(DA0G9095; DAAG29-79-C-0114)*

Block copolymers containing units from polymers with high thermal stability will be studied to determine whether these units will impart similar stability to the copolymers. Relevance: The proposed thermally stable polymers are relevant to problems requiring laser and fire hardened materials. In addition, recent work at AMMRC suggests they may be beneficial in mitigating the potential for accidental release of conductive fibers from advanced composites.

Oligomeric polybenzimidazoles with reactive end groups will be converted to block copolymers which have amides, esters, ketones, and sulfones as major structural features. The study of the biphenylene unit as a crosslinking agent will continue and be extended to other polyesters, e.g. terephthalates.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0005, MATERIALS SUPPORT TECHNOLOGY - LIQUID DROP IMPACT DAMAGE FOR CERAMIC MATERIALS

W.F. Adler, Effects Technology Inc., *Santa Barbara, California* 93105 (DN675494; N00014-76-C-0744)

The erosion of infrared sensor windows, infrared laser windows, and radomes exposed to rain, ice crystals and airborne dust and debris is a serious problem for all-weather subsonic and supersonic aircraft and missile systems. Studies of mechanisms of damage in crystalline inorganic materials at impact velocities ranging from 100 to over 1,000 feet per second will be carried out.

Work concentrates on damage by water drop impacts, influences of bulk material modifications on damage initiation and propagation, and materials' removal mechanisms. Materials include hot-pressed spinel, alumina and zirconium-toughened-alumina. They will be impacted with nylon beads and water droplets. They will be impacted with nylon beads and water. Included are static and dynamic indentation resistance, faracture thresholds, surface finish, microstructure. Interactions of water drops with model defects are to be examined. Fracture mechanics analyses and descriptions of erosion kinetics will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, IMPROVED *FRACTURE RESISTANCE IN TITANIUM ALLOYS*

C.R. Rhodes, Rockwell International Corp., Rockwell International Science Center, *1049 Camios Dos Rios, P.O. Box 1085, Thousand Oaks, California* 91360 (DN975548; N00014-79-C-0567)

Because of its light weight and high strength titanium is an important structural alloy used in aircraft and ships. This program will examine various processing controls on microstructure in order to increase the fracture resistance of selected titanium alloys.

The fracture resistance of Ti-6Al-4V and corona-5 titanium alloys will be increased by thermal treatments. Effects of aging temperature on size, distribution, volume fraction and composition of alpha and beta phases will be found. Powder-metallurgy-processed Ti-6Al-4V will be evaluated with respect to solution-treated microstructure and compared to the wrought alloy. Effect of microstructure on internal fatigue crack nucleation will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, MATERIAL SUPPORT TECHNOLOGY - CONTROL OF IMPURITIES IN THE EPITAYIAL GROWTH OF HIGH QUALITY GaAs

D.A. Stevenson, Stanford University, Center for Materials Research, *Stanford, California* 94305 (DN475330; N00014-75-C-0887)

The Navy has use for gallium arsenide electronic devices in microwave communications and surveillance systems. This program will investigate the control of residual impurities and electrically active centers in the synthesis of high purity epitaxial gallium arsenide.

A molecular beam mass spectrometer (MBMS) will be used as a diagnostic tool to evaluate gas phase chemistry relevant to crystal growth systems. In particular, the reaction tendencies of organometallic constituents of chemical vapor deposition sys-

tems will be studied. The role of zirconium as an oxygen getter in LPE growth of gallium arsenide will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0008, PARTICLE IMPACT DAMAGE AND EROSION OF CARBON-CARBON COMPOSITE AND CERAMIC MATERIALS

A.G. Evans, University of California, Berkeley Campus, School of Engineering, Dept. of Materials Science & Mineral Engineering, *Berkeley, California* 94720 (DN975217; N00014-79-C-0159)

Carbon-carbon composites (C/C) are prime candidates for use in RV nose cones and rocket nozzles. Ceramics such as Si3N4 are candidate materials for missile engines and domes. The use of these materials in the above applications requires microstructures that are resistant to erosion (material removal). This study has the following four objectives: (1) characterize the deformation processes leading to erosion, (2) determine the microstructural dependence of these deformation processes, (3) develop models of the erosion process and (4) analyze toughening mechanisms in ceramic-ceramic composites.

Carbon-carbon and model (glass fiber epoxy) materials will be loaded in compression. The deformation processes at defects will be characterized. Displacements at the defects will be analyzed and stresses in the fibers calculated. From these calculations strength/probability models for the fibers will be evaluated. Ceramic materials will be impacted with SIC or quartz particles. The resulting material damage will be characterized. The results will be modeled using fracture mechanics formulations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0009, MAGNETIC PROPERTIES OF LITHIUM FERRITE (15242-EL)

C.E. Patton, Colorado State University, School of Natural Sciences, Dept. of Physics, *Fort Collins, Colorado 80523* (DA0F9069; DAAG29-77-G-0209)

To investigate fundamental properties of titanium, zinc, cobalt and manganese substituted lithium ferrite microwave materials. Relevance: Direct and potential application in military electronic systems such as in Patriot, Firefinder and remotely-piloted vehicles.

The relation will be analyzed between magnetic order, magnetocrystalline anisotropy, magnetostriction, grain size, stress and temperature in ferrites supplied by U.S. Army Electronics Command and commercial firms.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0010, *MOLECULAR-BEAM STUDIES OF ORGANIC* REACTIONS

R.J. Cross, Yale University, School of Chemistry, Dept. of Chemistry, *206 Elm, New Haven, Connecticut* 06520 (CHE78-26137)

This research is in the area of quantum chemistry. Drs. Cross and Saunders intend to carry out a program of research involving three types of molecular beam experiments on the newly discovered gas-phase chemiionization reaction, SbF5 plus RX yields SbF5 X- plus R plus where RX is an alkyl, aryl, acyl, or alkali halide, SF6, UF6, etc. First they plan to investigate the basic chemistry of the reaction - which reactions work and which do not. To date they have seen more than two dozen reactions with the near certain prospect of many more. Second, they plan to use supersonic nozzle beams to vary separately the initial translational and vibrational energies of the two reactants and to determine the type of activation energy required for the reaction -translational or vibrational. This type of measurement will give information on the structure of the transition state (the position of the barrier on the surface). Finally, they plan to measure the angular and energy distributions of the products to determine the collisional mechanism of the reaction and its energy disposal.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0011, BASIC STUDIES OF METAL HYDROGEN ALLOYS

A.C. Ehrlich, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880012)

To determine the electronic and crystallographic structure and properties of metal-hydrogen alloys to establish a theoretical basis for understanding and predicting metal-hydrogen alloys of potential use in naval applications such as high temperature superconductors and hydrogen storage materials.

Experimental investigations of the superconducting transition, crystallographic structure and Fermi surface will be carried out on various materials using electrical resistivity, specific heat and de Haas-van Alphen effect measurements. Correlations between electronic and crystallographic structure and critical properties will be determined. Mathematical and computer techniques are employed to analyze the results in terms of quantum mechanical principles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0012, THEORETICAL STUDIES IN CHEMISTRY

K.F. Freed, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE75-01549)

Professor Freed is developing theories and theoretical methods to further understanding of a number of important chemical problems in the areas of photochemical reaction dynamics, molecular relaxation processes, and the electronic structure of atoms and molecules. The research work includes the following projects: Development of a theory of the photodissociation processes of triatomic molecules which provides the wavelength dependence of the fragment vibrational, rotational, and translational energy distribution. Research on a Franck-Condon description of collinear chemical reactions. Further development of Freed's previous theory of collision-induced intersystem crossing, to consider the contribution to crossing rates from individual collisional processes, as well as the dependence of these rates on the intermolecular potentials. Consideration of a theory of vibrational relaxation of molecules in condensed media, to determine the nature of the various T1, T2, and coherence transfer processes that can arise. Development of a fully quantum-mechanical theory of the time-independent Green's function for molecules in coherent radiation fields. Critical assessment of many-body Green's function-equations of motion methods, to determine their accuracy and value in the prediction of ionization potentials, electron affinities and X-ray photoelectron spectra. Research on effective Hamiltonian theories, to examine the contribution of nonclassical effects to atomic and molecular electronic structure. This is a renewal of grant CHE-7501549.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0013, RADIATION/CATALYTIC AUGMENTED COMBUSTION

M. Lavid, Exxon Research & Engineering Co., Government Research Laboratory, *1600 Linden Ave., Linden, New Jersey* 07036 (DF048730; F49620-77-C-0085)

AF function - advanced air-breathing engines, airborne reconnaissance and transport, weapon delivery and defense. Deficiency -present aircraft operation is limited by combustion-associated phenomena such as flammability, flame propagation, ignition and stable combustion. Insufficient understanding is available of basic mechanisms and processes associated with promising techniques for initiation and enhancement of combustion, and for concept feasibility evaluation for extending operability range and stability. Objective - to investigate and evaluate the feasibility of various techniques for extending current aircraft

operational limitations which are encountered due to combustion associated phenomena, with emphasis on photochemical and catalytic techniques. To formulate realistic mathematical models describing the ignition, combustion and stability enhancement phenomena. How work contributes - will provide additional understanding and modeling of processes associated with ignition, combustion and stability enhancement. Will aid in evaluating the potential of various techniques, including photochemical and catalytic, for providing efficient means of extending aircraft operational range beyond the presently available continuous flight corridor.

This program encompasses investigation and feasibility assessment of techniques for extending aircraft operational range. Emphasis will be on the study of photochemical and catalytic augmentation techniques to enhance combustion initiation, and reaction kinetics which restrict combustor operation via limits on flammability, flame propagation, ignition and stability. Other approaches such as use of laser irradiation, modified spark, and plasma-torch will also be evaluated. Vacuum ultraviolet and ultraviolet sources have been acquired and will be characterized using spectroscopic and combustion diagnostic techniques. Various catalytic flameholder configurations will be tested under afterburner conditions. Characterization of enhanced ignition and combustion by photochemical, catalytic and other techniques at aircraft combustor and afterburner conditions will be explored in a flow combustor operated both in a simple premixed mode and in a cannular combustion mode using gaseous and liquid fuels. Consistent experimental and theoretical descriptions of the ignition and combustion enhancement phenomena will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0014, EFFECT OF REFINING VARIABLES ON THE PROPERTIES AND COMPOSITION OF JP-5

M. Lieberman, Exxon Research & Engineering Co., Government Research Laboratories, *1600 Linden Ave., Linden, New Jersey* 07036 (DN889819; N00140-78-C-1491)

Identify and assess potential future problem areas relative to the properties and composition of domestic and foreign JP-5 fuels produced from petroleum over the next five to ten years. Emphasis will be placed on current specification fuels but the effects of relaxation of or changes in specifications will also be studied.

Establish current and future distribution of crudes, refineries and processing capability for producing JP-5. Determine any crude/refinery constraints that can limit the quantity or affect the chemical composition of JP-5. Determine the effect that demand for other fuels could have on the supply of JP-5. Determine how chemical composition and properties of fuel are influenced by specifications, crude oil types, processing, blending, handling and storage and what effects changes might have on engine or airframe components. Analyze projected changes in JP-5 properties and composition to identify potential future problem areas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0015, COMPATIBILITY OF LUBRICANTS WITH ADVANCED BEARING AND GEAR MATERIALS

D. Popgoshev, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN796811)

To assure the availability of lubricant/steel combinations for future propulsion systems which have optimum reliability with respect to bearing and gear performance.

Candidate bearing steels in combination with advanced ester lubricants will be evaluated for their rolling contact fatigue, scoring, friction and wear characteristics on two bench testers namely: the rolling contact (RC) fatigue machine and geared roller test machine (GRTM). The test will cover a range of temperature, load, sliding and rolling conditions. In addition various ratios of elastohydrodynamic (EHD) lubricant film to composite surface roughness will be run to determine the scalability of this factor to various lubricant/steel combinations. At least ten different bearing steels will be used in the program over a four-year period. These will include four case-hardened steels, three wrought steels. Any promising other new steels which become available during the course of this program will also be evaluated. Those which are corrosion resistant steels will be evaluated for their corrosion resistance by a modified ASTM test method. All tests will be compared to Hercolube, a lubricant/M50 steel, as a baseline.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

3.0016, ELASTIC AND INELASTIC SCATTERING BY SMALL PARTICLES

M. Kerker, Clarkson College of Technology, School of Science, Dept. of Chemistry, *51 Main St., Potsdam, New York* 13676 (CHE80-11444)

This grant is for a theoretical program in the Structural Chemistry and Thermodynamics Program. Professor Kerker is engaged in the study of inelastic light scattering from colloidal particles. The particular problems studied are Raman spectra of molecules absorbed on the surfaces of small cylindrical and spheroidal particles with and without internal molecular structure. The goals of the program are to understand the large (up to 10 to the 6th power) enhancement which takes place in the intensity of the Raman spectra of molecules located on colloidal particles, trying to relate this effect to a similar enhancement for molecules on plane surfaces, to see if results for colloidal particles can lead to the use of light scattering as a probe of particle structure (with some emphasis on biological particles), and to understand the scattering of evanescent waves from adsorbed particles. The enhancement of Raman spectra has the potential for making Raman spectroscopy a tool for studying adsorbed species. This is presently not possible due to low signal strengths involved. This research represents a continuation of that currently supported by the Foundation grant CHE 7713102.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, COMPUTATIONAL STUDY OF NONADIABATIC EFFECTS IN ATOM-MOLECULE REACTIVE SCATTERING

M. Redmon, Battelle Memorial Inst., Battelle Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DF054510; F49620-79-C-0050)

AF function - Air Force operation in detection, surveillance, and other areas require knowledge of gas phase energy exchange mechanisms. Deficiency - there is a lack of detailed understanding of how energy transfer occurs between species in the atmosphere and in lasers. Objective - the goal of this research is to develop quantum mechanical computational techniques to study nonadiabatic effects in three-dimensional atom-diatom collisions. How work contributes - the results of this effort will lead to a fundamental understanding of energy exchange processes in atmospheric chemistry, combustion and lasers.

The first phase of this program will be devoted to obtaining a computationally feasible basis for representing the scattering wavefunction for rearrangement collisions involving ground and excited-state carbon and oxygen with singlet sigma and doublet pi molecules. Then, couplings responsible for non-adiabatic transitions will be obtained, initially from diatomics-in-molecules theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0018, FATIGUE IN POWDER METALLURGY ALUMINUM ALLOYS

A. Lawley, Drexel University, School of Engineering, Dept. of Metallurgical Engineering, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DF047690; AFOSR-77-3247)

AF function - the longevity, reliability and safety of aerospace structures are related to the fatigue properties of the structural materials used. Opportunity - since the fatigue properties of structural materials often limit their application, it is im-

portant to understand the mechanism of fatigue and especially the metallurgical means by which fatigue resistance may be improved. Objective - this research will establish and quantify processing-microstructure-mechanical behavior relationships in fully-dense powder metallurgy materials. Particular interest centers on fatigue response in aluminum-base alloys and includes the roles of stress state and environment. How work contributes - since aluminum alloys form a major portion of the material currently used for skin and other structural airframe applications, it is appropriate that they are the basis of this investigation.

The fundamental understanding of the fatigue behavior of powder-metallurgy-processed aluminum alloys to be developed during the course of this research will provide the basis for carrying out future alloy and process development to achieve improved materials. In addition, the principles developed during the course of this investigation should also be applicable to other age-hardening systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, NOVEL LOW-DIMENSIONAL CONDUCTORS

M.M. Labes, Temple University, School of Liberal Arts, Dept. of Chemistry, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (DMR79-05979)

Intense efforts are currently under way to understand the relationship between crystal structure, chemical formula, and the highly directional physical properties of so called low-dimensional solids. Several molecular and polymeric 'metals' or semiconductors of this type have been prepared and studied, both theoretically and experimentally, in the last few years. It is highly desirable to synthesize new materials designed specifically to test theory and extend the range of phenomena observed, possibly creating totally new classes of conductors.

Three types of novel low-dimensional conductors will be prepared and studied. Hydrocarbon-halogen complexes are of interest because Professor Labes and coworkers have discovered that perylene-4 iodine has a metallic temperature dependence of its conductivity and may not be a simple segregated stock complex. Understanding its properties may result in a basic revision of the guidelines for the structure of metallic charge transfer complexes. Second, a class of channel-like inclusion compounds is of interest because both significant fast ion and electronic conductivity have been observed in these compounds. Last, this group is investigating the synthesis and properties of a new polymeric system and its charge transfer adducts which show promise of high conductivity.

This is the first year of a three-year continuing grant; renewal of work supported by DMR 77-01055.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0020, LOW FREQUENCY COMPOSITE MATERIAL EM BEHAVIOR AND ITS EFFECT ON MILITARY SPECIFICATIONS AND STANDARDS

W. Duff, Atlantic Research Corp., *5390 Cherokee Ave., Alexandria, Virginia* 22314 (DN890258; N00019-80-C-0150)

NAVAIR is evaluating the impact of composite material em properties on aircraft design.

Composite material EM properties below 1 GHz will be reviewed and summarized by Atlantic Research Corporation. The summary of composite material EM properties will be tabulated in a report useful for reviewing current military specifications and standards and for dissemination to composite aircraft system designers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0021, AN INVESTIGATION OF THE ELECTROCHEMICAL BEHAVIOR OF GRAPHITE FIBER-POLYMER COMPOSITES (16002-MS)

G.E. Stoner, University of Virginia, School of Arts & Sciences, Dept. of Material Science, *Garrett Hall, Charlottesville, Virginia* 22903 (DA0G8964; DAAG29-79-G-0027)

To study multiple interfacial electrochemical interactions within graphite fiber-polymer composite electrode materials to gain an understanding of the factors affecting stability and electrode performance. Relevance: This research is relevant to the design and construction of advanced fuel cell electrodes and matrices for the fuel cell program of MERADCOM, to ongoing research to determine better anode materials for the cathodic protection of Army structures, and the degradation of graphite fiber-polymer matrix materials for missile and aircraft structural applications.

This research will include: (1) study of the roles of fiber composite electrode composition and structure in degradation in ionic media; (2) electrochemical and microscopic evaluation of the stability and performance of electrodes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0022, VULNERABILITY METHODOLOGY AND PROTECTION TECHNIQUES FOR AIRCRAFT FIRE AND EXPLOSION

F. Tolle, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF462840; F33615-78-C-2063)

Development, refinement and verification of ullage flammability prediction model. Investigation of optimum protection techniques for JP-8 type fuel. Develop improved fire control techniques and associated design criteria for engine/auxiliary equipment compartment fire zones.

This program will utilize aircraft fuel tank and engine fire test simulators which will be located in Bldg 71B, I-Bay. These unique test capabilities will enable in-depth quantitative assessment of dynamic fire initiation, sustenance and suppression measurements involving variety combustible fluids and realistically simulated tank/nacelle environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DESIGN FABRICATION AND ENGINEERING SUPPORT OF ATTITUDE CONTROL SYSTEMS

S.D. Lyon, Space Vector Corp., *Northridge, California* (DF248830; F19628-77-C-0251)

AF function - direct support of SAMSO infared measurements program. Deficiency - lack of knowledge of rocket attitude control and behavior. Objective - to provide the Air Force with a reliable, accurate, and low cost attitude control system (ACS) for ARIES sounding rockets. How research contributes - provides rocket-borne payloads with sufficiently accurate attitude control for probing the infrared aerospace environment.

Develop and fabricate a state-of-the-art, highly accurate attitude control system for the ARIES rocket.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0002, MATHEMATICAL PROBLEMS OF NONLINEAR WAVE PROPAGATION AND OF WAVES IN HETEROGENEOUS MEDIA

J.B. Keller, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF056620; AFOSR-79-0134)

AF function - aerospace vehicle design. Opportunity - recent experimental and theoretical work suggests a possibility for improved models for turbulence. Objective - to explore new ideas for models involving nonlinear partial differential equations. How work contributes - such models could suggest innovative approaches to aircraft and missile design.

In a fluid undergoing shear flow nonlinear waves are generated in boundary and mixing layers. Large localized structures

such as turbulent spots and regular rolled up vortices occur. Techniques developed on analogous but simpler systems of nonlinear equations will be used to derive equations governing the envelope of a wave disturbance such as a turbulent hot spot. Analytical techniques include nonlinear stability theory and the derivation of complicated subcritical bifurcation diagrams. In addition techniques used for nonlinear surface waves will be extended to mixing layer with possible applications including vortex rollup.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, DYNAMIC SYSTEMS

D.G. Luenberger, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DF046370; AFOSR-77-3141)

AF function - the design and integration of electronic systems and aerospace vehicles. Deficiency - the optimal design of complex systems is hampered by the problems of effectively interfacing constituent parts and subsystems. Although the state space basis of dynamic systems and their optimal configuration are now well developed, the application of these principles to even moderately complex problems is often too difficult for cost effective implementation. Objective - to develop systematic theories of approximations, and to unify the existing useful design methods that have evolved from ad hoc ideas. How work contributes - progress achieved in this area would permit more sophisticated and powerful systems to be designed and built in a cost-effective manner.

The initial efforts will consider three interrelated projects -- positive systems, aggregation, and information simplification. Positive systems arise frequently in practice, and the theory is the most advanced here. Therefore, the known results can serve as a standard for comparison in treating other systems. The theory can be used as a tool also in investigating the long standing problem area of aggregation. The topics of information simplification can be attacked by methods of aggregation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, THE ELECTRICAL AND METALLURGICAL PROPERTIES OF DEFECTS IN COMPOUND SEMICONDUCTORS (15589-EL)

G.L. Pearson, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DA0F9193; DAAG29-78-C-0018)

To investigate the physical and electronic properties of lattice and impurity defects in III-V compound semiconductors. Relevance: The III-V semiconductors to be studied in this work are relevant to several Army technologies. These include microwave devices, such as FET's, IMPATT's, and TELD's, and electro-optic devices, such as photocathodes, imaging CCD's and semiconductor lasers.

The synthesis of AlGaAs, GaInAs, and GaAsSb will be accomplished by liquid-phase epitaxial and molecular beam epitaxial growth. The resulting materials and device structures will be studied by a multiplicity of experimental techniques in order to identfy and characterize substitutional impurities, vacancies, vacancy-impurity complexes, and constituent interdiffusion. The experimental techniques to be employed include photoluminescence, transient capacitance measurements, deep-level transient spectroscopy, and Auger spectroscopy.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0005, AIRBORNE ELECTRO-OPTICAL SENSOR SIMULATION STUDY- PHASE II, NON REAL TIME SIMULATION

J.W. Bell, Technology Service Corp., *2811 Wilshire Blvd., Santa Monica, California* 90403 (DF227400; F33615-74-C-4069)

The objective of this effort is to develop techniques for simulating in non real time the performance characteristics of forward looking infrared or low light level television system. This simulation would include the video display presentation representative of that of the airborne system. The total simulation will be used to validate techniques for describing total sensor system interaction with real world. This effort is to result in the development of a research tool for use in developing sensor simulation technology and will serve as the basis for design of future sensor simulation systems.

The approach employed in this effort will involve the modeling of the real world targets, the atmosphere and sensor for implementation on a digital computer. Maximum utilization of computer image generation technology will be effected for this program. The total system interaction with real world environment will be simulated in non real time. Simulated missions will correspond to actual missions so that comparison between simulated and actual performance can be made directly. Various algorithms for atmosphere and sensor will be employed and suitable expansion capability will be provided to enable altering transfer characteristics of sensor and external environment. This is to provide a more comprehensive information for development of sensor simulation technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0006, FORMAL VERSUS SITUATIONAL MODELS OF EXPERT DECISION-MAKING

S.E. Dreyfus, University of California, Berkeley Campus, School of Engineering, Dept. of Industrial Engineering, *Berkeley, California* 94720 (DF052240; F49620-79-C-0063)

AF function - this research is very important to the fundamental structuring of training in the Air Force since it provides knowledge about the basic cognitive mechanisms involved in the acquisition of high proficiency skills and explores a method of instruction to improve the acquisition process. Deficiency - the traditional apprenticeships of young flyers is being eroded as flying hour programs are cut. Ample flight time does not appear to be available to provide the types of experiences which 'matured' earlier generations of crew members. In the absence of these maturing experiences, the types of experiences which can effectively substitute for the traditional apprenticeship must be determined. Objective - the objective of this research is to explore the differences between formal decision theory and situational sensitive expertise as it relates to the acquisition and performance of higher order skills of the type required in flying. How research contributes -this effort will support other basic and applied research directed at cognitive processing in aircrew members, especially in the domain of training emergency procedures.

The principal investigators will analyze a wide variety of scientific literature and report on the support found for the formal decisive theorists and for the situational theorists. Several experienced pilots will be interviewed, with emphasis on the role of experience in critical flight situations, to determine the suitability of both theorists. Preliminary experimental testing of certain proposed brain instantiations of the situation model will be tested as well as acquisition of tactical decision-making skills through situational training. Neurophysiological models will also be studied to see if they can account for any of the behavior of interest.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, COMMUNICATIONS - INVESTIGATIONS IN OPTICAL GUIDED WAVES

C.W. Yeh, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Electrical Science & Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DN675158; N00014-76-C-0321)

Dielectric waveguides are in increasing Navy use in fiber optics, and will be used for integrated optics and millimeter wave communications and radar systems. This research involves theoretical and experimental research on the wave-guiding and wave amplification characteristics of various dielectric waveguide structures.

The amplification of electromagnetic waves propagating in a dielectric waveguide with an active core or within an active medium is being investigated analytically and experimentally. Analytical techniques are being developed to treat coupling

among more than two inhomogeneous waveguides and between two dissimilar guides.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, NEW METHODS FOR ANALYSIS OF THE PERFORMANCE OF GUIDANCE AND CONTROL SYSTEMS

R.S. Bucy, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF045840; AFOSR-76-3100)

Af function - develop new estimation techniques for the design of high accuracy guidance, navigation, and control systems for sophisticated Air Force systems. Deficiencies - the estimation or noise filtering problem in many cases is inherently nonlinear and therefore not amenable to known linear filtering techniques. Objective - the objective of this research is to develop methods for routinely handling nonlinear filtering problems. How work contributes - better techniques for nonlinear filtering will find immediate application in improved performance and accuracy for complex systems.

Research will be pursued in two areas. In the area of information theory and filtering some preliminary results have been obtained which characterize the constrained rate distortion function for discrete sources. The constraint imposed requires the realizability of the approximating signals. The intent is to look into developing a complete constrained rate distortion theory for both continuous and discrete sources. In the area of implementation of nonlinear filters faster algorithms will be developed for the two-dimensional optimal demodulator on the CRAY-1 computer. Further, an investigation of the effect of large memory requirements on the relative speed of the CRAY-1 versus the STAR-100 will be done to see if the CRAY speed degenerates in the presence of large memory requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, LASER KINETIC SPECTROSCOPY OF ELEMENTARY PROCESSES

C. Wittig, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG79-08598)

This grant is for the support of a research program which is aimed at applying laser kinetic spectroscopic techniques toward the solution of a number of important problems in the area of elementary gas phase processes. Emphasis is placed on the development of diagnostic techniques which will allow precise measurements of state specific elementary processes. Both unimolecular and biomolecular processes will be studied. Excited species are prepared either with an excimer or CO2 laser, and kinetic processes are monitored via LIF or direct fluorescence. Some of the experiments are of a very applied nature (IR photolysis of UF6), some are of a nature that they do not necessarily have immediate application (real time measurements of unimolecular processes under collision-free conditions), and some experiments will open up new areas for exploration (LIF and imaging techniques applied to molecular beam experiments).

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0010, T-HELIX TECHNOLOGY

A. Scott, Varian Associates Inc., *611 Hansen Way, Palo Alto, California* 94303 (DN980345; N00173-79-C-0050)

Develop high power traveling wave tube technology with a 2 to 18 bandwidth capability, 500 watts CW output power, and 40 dB gain. This technology will provide future EW systems with adequate electronic countermeasures capability to protect naval aircraft ships against missiles thru jamming and target return deception.

Develop a new T-helix circuit technology for traveling wave tubes with both high-power and extremely wide bandwidth capability in a single tube. Two new techniques will be used to achieve the desired bandwidth. The required negative dispersion is provided by the T-helix structure and gain stability across the band will be provided by variable length resonant loss technique. The high-power capability will be provided by using 6 support rods on the helix.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0011, RESEARCH ON SUBMICRON SUPERCONDUCTING QUANTUM DEVICES

D.E. Prober, Yale University, School of Arts & Sciences, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (ECS79-27165)

This program is a theoretical and experimental investigation of submicron superconducting quantum devices. Interest is focused on thin film metallic microbridges that serve as Josephson elements. New x-ray lithographic techniques for fabricating microbridges and the extension of microbridge applications to the low noise detection of far-infrared signals are under study. The investigation includes the development of device models that characterize the effects of both the presence of normal and superconductive currents in the junction and the finite transit time for electrons in the junction. Theoretical work on the junctions is aimed at including geometric effects and the effects of differing material properties in the models. A principal goal of the experimental program is to fabricate junctions with dimensions in the 100 angstrom range.

This is a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0012, LOW PRESSURE RF ANNEALING - A NEW TECHNIQUE FOR REMOVING EXCESS CHARGE CENTERS IN MOS STRUCTURES (15835-EL)

T. Ma, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (DA0G9001; DAAG29-79-C-0021)

To study charge centers such as fixed charges, surface states and oxide traps in and their removal from metal-oxide-semiconductor, silicon-on-sapphire or metal-nitride-oxide-semiconductor structures. Relevance: This research is relevant to the entire electron device technology with special reference to annealing of radiation damage in integrated circuits and radiation-hardened devices.

Various ionizing sources will be used to generate excess charge centers in a controlled fashion. The centers will be analzyed by ac differential conductance techniques in conjunction with C/V methods.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0013, LASER COOLING OF NEUTRAL BEAMS

W.D. Phillips, U.S. Dept. of Commerce, National Bureau of Standards, Electrical Measurements & Standards Div., *Washington, District of Columbia* 20234 (DN075128; N00014-80-F-0035)

The efficient cooling of neutral atomic beams by lasers could lead to slow cesium beams for atomic clocks, very low energy collision studies, and very high resolution stored neutral atom spectroscopy. Advances in timing standards enable the Navy to fulfill its responsibility to the Department of Defense in providing time and frequency services. Accurate timing is of interest to the Navy through improved navigation, rapid transmission of digital data, and long baseline interferometry.

Initial experiments are being performed in which a fixed frequency laser is projected colinear with a sodium beam. The laser is tuned to the 3 S(1/2) to 3 P(3/2) transition. A velocity analysis is being done near the atomic beam source and 50 cm downstream.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0014, E.O. HULBURT CENTER
H. Friedman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN080147)

E. O. Hulburt Center (visiting scientist program). The E. O. Hulburt Center for Space Research provides research opportunities in space science in the NRL Space Science Division for appointees from universities and other institutions. The purpose of this Hulburt Center program is to enable the space science effort to benefit from the infusion of young scientists in the style of post-graduate research, and, on occasion, from the expertise of more senior outside researchers. The technical objective of the division is to conduct research in the fields of upper air physics, astronomy, astrophysics, and remote geo-sensing to gain fundamental understanding for ultimate DOD application.

Visiting researchers from universities or research institutions are supported while in residence at NRL for specified terms. This project provides funding to support the visiting appointees under intergovernmental personnel act agreements, consultant contracts or such other instruments as carry approval of the NRL administration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0015, RADIO SOURCES
P.R. Schwartz, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880100)

Conduct research leading to application of natural radio sources and related technology for improvement in areas of navigation and guidance, signal detection, remote sensing and surveillance.

Detect and map extragalactic, galactic, and solar system radio sources with current emphasis on identification of radio sources with optical and infrared counterparts, such as stars. Determine size, structure and positional relationships by interferometer techniques for relating radio and optical/IR components and position reference systems. Investigate emission mechanisms particularly in relation to radio/optical IR positional coincidence, and the physical relationships of radio sources in prestellar and stellar evolution.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0016, RADIATION HARDENING OF POWER SYSTEMS
R.L. Statler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980059)

The objective is to develop the technology for improved, hardened primary power systems for remote military applications such as earth-orbiting satellites and strategic and tactical applications relating to surveillance, communication, and weapon systems. The near term objectives are to compare technical advantages and limitations of state-of-the-art non-fossil fuel power sources, such as radioisotope thermal generators, thermal electric and photovoltaic. The hardness of these energy sources will be assessed for particle and gamma radiation environments.

Comparative parametric studies of various state-of-the-art power sources will be made in connection with specific operating environments, including space and terrestrial. Limitations in the adaptation or utilization of power source options will be determined. Data from unattended prolonged operation will be analyzed. Radiation hardness of power source materials will be investigated by analysis and experimental investigation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0017, PILOT HELMET MOUNTED DISPLAY SYSTEM
D. Breglia, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulation Concepts Lab., *Orlando, Florida* 32813 (DN994011)

Design and construct a feasibility model of a pilot helmet mounted display system. Design will use latest technologies in the fields of area of interest, computer image generation, head and eye tracking systems to produce small, mobile inexpensive design with superior performance characteristics.

System concept will be formulated and required basic research and high risk areas will be defined. Several experiments will be designed to define parameters required to accommodate the capabilities of the human in the system loop. Studies to determine some of the human physical characteristics and limitations will be made to determine maximum allowable system delay and techniques to minimize them. A breadboard to demonstrate an acceptable system time constant will be built and demonstrated. Study will be made on the visual subsystem to define required parameters. A system design will be formulated and a specification based on the design will be written. Construction of the system either in-house or under contract will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulation Concepts Lab.

4.0018, SPACE/FREQUENCY CONVERSIONS IN IMAGE TRANSMISSION AND PROCESSING
W.T. Rhodes, Georgia Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF053640; AFOSR-78-3720)

AF function - advanced terminal guidance processors will permit maneuverable reentry vehicles to take evasive action while ensuring accuracy of delivery. Opportunity - the fundamental difficulty in achieving a practical terminal guidance system lies in real-time correlation of the stored reference image with an input image that differs in scale, aspect, contrast, and even content when sensed in a different spectral band or at a different time then the reference image. The most promising technology is optical processing with its increasing repertoire of space-variant data processing operations. Objective - the proposed research will investigate a space coordinate-to-temporal frequency mapping technique that should allow a one-to-two-orders-of-magnitude increase in the number of full frame correlations that can be performed per second on a one million pixel image. How work contributes - this effort will advance optical processors for terminal guidance applications.

A pair of crossed acoustooptic cells driven by periodic waveforms will be investigated as a method of realizing the required image encoder. Characteristics and limitations of both coherent and incoherent decoding techniques will be studied. With regard to the processing operations, the effort will investigate tradeoffs between full analog operation and partial digital implementation coupling between the optical and electronic components, and tradeoffs between CCD, SAW, and intergrated optics implementation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, COMPUTER SIMULATION OF KINETIC PROPERTIES OF PLASMAS
J. Denavit, Northwestern University, Evanston Campus, Technological Inst., Dept. of Mechanical Engineering & Astronautical Science, *633 Clark St., Evanston, Illinois* 60201 (DN223216; N00014-75-C-0473)

Develop theory and numerical methods for plasma simulation and related problems in ionospheric and magnetospheric phenomena of interest to the Navy for application to communication systems via the ionosphere. Study very-low-frequency (VLF) emissions from the magnetosphere including the evolution of whistler sideband instability and whistler wavepackets, and the stability of field-reversed ion rings.

Theory and computational methods are developed for simulation studies of the evolution of whistler sideband instability under magnetospheric conditions. This includes extending the nonlinear evolution of whistler wavepackets in a nonuniform external magnetic field to the case of a whistler wave spectrum. Computer studies are also conducted on the stability of field-reversed ion ring equilibria confining finite pressure plasmas.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, STUDIES OF IONOSPHERIC SCINTILLATION PROBLEMS

C.H. Liu, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (ATM80-07039)

Radio waves, in passing through irregularities in Earth's ionosphere, suffer scintillation or fading, even on occasion at the very high (GHz) frequencies used in satellite communications. This grant funds investigation of the ionospheric scintillation phenomenon via two complementary approaches. The first continues efforts in developing a comprehensive statistical scintillation theory based on theoretical analysis and experimental verifications. Existing theories will be quantified, using the expanding body of scintillation data and simultaneous observations from other experiments, especially for the strong scintillation situations. The second approach involves the development of a numerical propagation computer code. The ionospheric irregularity models will be constructed based on in-situ measured electron density data and results from simulation computations. This approach will be applied to situations where the statistical theory may not be valid. The technique will also be used to obtain deterministic descriptions for the structures of the irregularities. In both approaches, the theoretical analysis will be closely checked with observational data. This dual approach should both improve understanding of the interactions between radio waves and irregularities that lead to scintillation phenomena, and gain information about the characteristics of various types of ionospheric irregularities.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0021, NAVIGATION-SUPPORT FOR SATELLITE NAVIGATION SYSTEMS AN/WRN-4

J. Stelle, Magnavox Government & Industrial Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (DN123404; N00014-77-C-0184)

Advance design satellite navigation equipment models AN/WRN-4 have been procured in limited quantity to provide high accuracy, all-weather, global positioning capability required to support at sea R&D efforts. these systems are fully automatic, completely integrated, compact in size and lightweight to facilitate transfer between users while preserving high reliability and maintainability. Centralization of spare parts and repair facilities for those sophisticated and unique equipments assures continued quality control, accurate performance history and minimum investment in back-up spares.

The contractor will provide a bonded warehouse for maintaining a pool of spare parts, will provide a supervisor to maintain liaison with equipment users in equipment trouble shooting and spare parts replacement; will maintain inventory records, parts failure analyses and equipment performance data; will ensure timely repair of faulty parts, their inspection and their return to stock in accordance with proposed procedures; will maintain five GFE model AN/WRN-4 (MS706MA) equipments for emergency back-up equipments spares; and will provide field assistance for installation and operator training.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0022, ELECTRON BEAM LITHOGRAPHY OF PROTEIN MONOLAYER, ULTRATHIN COMPOSITE RESIST FILMS

J.H. McAlear, E M V Associates Inc., *15825 Shady Grove Rd., Rockville, Maryland* 20850 (DAR80-09745)

Packing density and speed of computing elements are directly related to the resolution achievable by a given lithographic approach. Ultimate computational capability of new, low heat dissipating or noise process, such as CCD's, bubble memories, or Josephson junctions, are limited in part to 2500 A resolution provided by state-of-the-art electron beam or X-ray lithography. To produce lines substantially below this limit, novel approaches to resist materials and lithography are needed.

This research is aimed at demonstrating that high resolution (100A) masks can be achieved using ultrathin composite resist films. These films are formed by enveloping a protein monolayer with a resist on a support film and exposing the film with an electron beam so as to 1) minimize electron scatter effects and 2) allow chemical linking of active enzymes to the protein. These enzymes catalyze reactions that deposit X-ray or electron dense materials such as Pb, Ag, Ru and Te.

Protein affinity and enzyme-catalyzed reactions permit the specific deposition of many chemical elements, either individually or in combination. The implications of this approach include novel deposition capabilities, high resolution and potentially higher writing speeds. More significantly, however, is the possibility of developing these proteins substrates into specifically oriented templates for the organization of protein macromolecules and other polymeric materials into functional elements of ultramicrodevices.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Applied Research

4.0023, ULTRASONIC AND ACOUSTIC EMISSION DETECTION OF FATIGUE DAMAGE

R.E. Green, Johns Hopkins University, School of Engineering, Dept. of Mechanics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DF043500; F44620-76-C-0081)

AF function - Air Force advanced aerospace vehicles require increased design emphasis on durability and inspectability. New techniques for nondestructive evaluation (NDE) are needed to reduce operation and maintenance costs. Deficiency - cost factor estimates for advanced Air Force systems are quite expensive and, as such, not desirable. New inspection techniques coupled with fracture mechanics analysis methods are needed to effectively reduce Air Force serviceability costs. Objective - the object of this research is to extend the state of knowledge involving ultrasonic attenuation and acoustic emission applications and their attendant correlations with hardware used in typical Air Force flight systems. How work contributes - this research contributes to the Air Force program seeking to enhance the reliability and durability of aerospace structures.

Techniques of ultrasonic attenuation and acoustic emission will be used in this research. Experimental techniques and monitoring systems will be investigated to correlate defect initiation and growth characteristics. At a later date studies will evaluate the differences that exist between laboratory specimens and actual aircraft components.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, AIRBOAT ARRAY PLATFORM

J. Ramsey, MAR Inc., *1335 Rockville Pike, Rockville, Maryland* 20852 (DN975803; N00014-79-C-0734)

To design, procure, fabricate, and test an airboat to serve as a low cost test platform for towed array self noise measurements.

The approach is to take advantage of previously funded Army and Navy airboat development work and current aircraft state-of-the-art to specify and design an airboat with sufficient power and quietness to serve as a test platform for towed-array self-noise measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0025, RESEARCH IN DIELECTRICS

F.B. McLean, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0E5735)

To identify the mechanisms responsible for the radiation response of insulating materials used in integrated circuits, cables and capacitors.

Examine the radiation response of insulators to short pulse and steady state irradiation. By investigating this response under various conditions of bias, temperature and radiation stress,

identify the controlling mechanisms and develop prediction models for the transient and long term radiation response.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0026, NMMW OPTICALLY PUMPED SOURCES

G.J. Simonis, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Harry Diamond Lab., *2800 Powder Mill Rd., Adelphi, Maryland* 20783 (DA0F5730)

The near-millimeter (NMM) portion of the spectrum, 0.3-2.5 mm, will play an important role in close support, remote sensing systems which (1) operate well under smoke, inclement weather, or cloud environments, (2) provide high resolution capability and (3) are secure in terms of countermeasure vulnerability. NMMW technology addresses these requirements being an attractive compromise between the high resolution capability of IR systems and the low propagation losses characteristics of microwave operation. The objective of this program is to foster and contribute to the development of the technology base in this relatively unexplored portion of the EM spectrum.

The NMM technology program is based upon three complimentary approaches. First an in-depth study is being conducted of the state-of-the-art to (1) define current and future systems requirements and (2) identify technology gaps and research efforts to fill these gaps. Second, an in-house research program is underway for the development of NMMW sources which have practical power/size capabilities and high spectral purity. The third portion of this program is an out-of-house effort in the three areas of sources, receivers and propagation effects.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Harry Diamond Lab.

4.0027, SPACEGRAPH IOS DISPLAY STUDY

L.D. Sher, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF228820; F33615-79-C-0013)

The objective of this effort is to study the various ways in which the unique 3-D capabilities of the SPACEGRAPH display can be matched to the specialized display problems of the IOS of a modern flight simulator.

The study will examine the overlap between the information-display attributes of an IOS and the corresponding attributes of SPACEGRAPH which promise utility in IOS applications. The work will include identifying and categorizing the types of information to be displayed and current characteristics of SPACEGRAPH which are applicable, developing new ways of using SPACEGRAPH and examining those characteristics which promise utility, developing additional parts of the SPACEGRAPH system, generating priorities for future developments and demonstrating the system. Project initiated - 11 Oct 78; contract awarded - 1 Dec 78; display requirements - 1 May 79; new uses - 1 Oct 79. Ronald G. Hughes is co-monitor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

4.0028, CURRENTS AND CHARGES ON CYLINDERS IN A PARALLEL PLATE TRANSMISSION LINE

M. Krook, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Applied Mathematics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DF044580; AFOSR-76-3073)

AF function - the determination of the magnitudes and distributions of surface currents and charges induced on the metal skin of aircraft when exposed to a possible electromagnetic pulse (EMP) from a high altitude nuclear burst is both theoretically and experimentally a difficult problem. The experimental approach is to make direct measurements with sensors distributed over the surface of an actual aircraft when it is illuminated by a simulated EMP. One form of simulator is the parallel plate device such as ALECS, ARES and the proposed trestle structure at the AFWL. Deficiency - it is not obvious nor is it easily proved that the field in the parallel plate section has the characteristics of an EMP. This program will aid in answering that issue. Objective - the intent of this work is to make measurements in a scale model parallel plate simulator and compare these measurements with the distributions of induced surface densities of current and charge in relative amplitude and phase on an obstacle in a configuration known to launch a plane wave field. Contribution - this work will provide important direct evidence about the efficiency of a parallel plate simulator.

The model simulator developed for measuring the amplitudes and relative phases of surface currents and charges on single thick cylinders will be employed to make selected measurements on crossed thick cylinders and a vertical cylinder with flat plates as horizontal arms over a ground plane. A study of the analytically determined field distributions in these structures and their dependence on dimensions and frequency will be obtained. The electromagnetic pulse generated in the simulator is significantly different from that resulting from a nuclear explosion in the atmosphere. In order to make observations in the simulator meaningful, it is evidently necessary to determine the nature and origin of these departures and to seek means to eliminate them. This is the primary purpose of the proposed investigations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, TRANSPORT, DIELECTRIC AND SWITCHING PROPERTIES OF METAL-OXIDE (MOX) NB0 SUB 2 SUPPRESSOR DEVICES (13978-P)

B. Lalevic, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Electrical Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DA0F9136; DAAG29-80-C-0072)

To study switching, transport and dielectric properties of the metal-oxide (MOX) Nb0 sub 2 suppressor devices. Relevance: These materials are used as high speed switches in the input circuit of receivers.

Conduction mechanism in Nb0 sub 2 devices will be investigated by the measurement of the I vs. V and DI/DV characteristics as a function of temperature. AC conductivity as a function of temperature and frequency will also be investigated. Data on dielectric dispersing will be obtained from Cole-Cole and Scaiffe plots. Loss tangent as a function of frequency and temperature and C vs. V sub 6. Temperature measurements will be made in the frequency region 0.1-10(6) Hz. Dielectric breakdown will also be studied. Structural changes will be investigated by scanning and electron microscopy.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0030, PLASMA DYNAMICS FOR POPULATION INVERSION

R.L. Liboff, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DF051870; AFOSR-78-3574)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of energy transformation processes occurring in plasmas such as X-ray lasing media. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research. Objective - this project will investigate theoretically the fundamental characteristics of energy transformation processes. It will specifically study the plasma dynamics aspects of population inversion for x-ray lasing media. Contribution - this work is part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, The development of advanced electromagnetic weapons (laser and particle beam) the development of space and ionospheric communications and the development of countermeasures.

Research will continue on a model for population inversion for a recombining, expanding ionized gas. Atoms in the model are finite potential wells whose geometry is chosen so that atoms have only three excited states. The research divides into three levels: (1) Atomic states. In this phase the life-times and

transition probabilities for excited levels are established. (2) Kinetic theory. In this state, the evolution in time of the distribution functions and number densities of the various species of particles will be examined. The model contains six kinds of particles - electrons, ions atoms in the ground state, atoms in the first excited state, atoms in the second excited state, and photons. Kinetic equations of the Fokker-Planck and Krock-Bhatnager-Gross type will be formulated. (3) Thermodynamics. A Gibb's function approach will be applied to the case of an expanding and cooling plasma.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, VISCID AND INVISCID FLOWS
D.A. Caughey, Cornell University, Ithaca Campus, Sibley School of Aerospace & Mechanical Engineering, Dept. of Mechanical Engineering, *Ithaca, New York* 14850 (DN775078; N00014-77-C-0033)

The development of accurate methods for the prediction of the flow fields about aircraft and missiles is essential for their design and optimization. The proposed research will be directed to: the development of finite difference techniques for solving the complete potential equation for the transonic flow about three-dimensional configurations, and the study of separation in time-dependent flows by Lagrangian techniques.

The development of accurate predictive techniques for increasingly complex flows is an evolutionary one. The first part of the planned research will adapt recently developed multigrid techniques to the flow about wing-fuselage combinations, thereby significantly reducing computing times. The second part of the research will examine fundamental concepts in time-dependent separated flows within the framework, initially, of boundary layer theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0032, THE PROPAGATION MECHANISM OF PRESSURE FLUCTUATION IN TURBULENT FLOW
V. Zakkay, New York University, School of Science & Engineering, Dept. of Aeronautics & Astronautics, *Washington Sq., New York, New York* 10003 (DF042080; AFOSR-79-0128)

AF function - advanced aerospace vehicles. Opportunity - better understanding of turbulent flows. Objective - investigate the mechanisms of pressure fluctuations in a turbulent boundary layer and influences to the turbulent structure by active and passive perturbations of the flow. How work contributes - improvement in our physical understanding of turbulent flows will result in improved design capability for advanced aerospace vehicles. A better knowledge of turbulence production could indicate possible ways to influence a fully-developed turbulent flow without using additional energy. One possibility is suitably designed flexible walls. Altering the character of the turbulent flow should make it possible to reduce surface drag and turbulence-induced aerodynamic noise.

An experimental program has been established to study the change in the large scale dirturbances called 'bursts' due to introducing controlled sources of pressure fluctuations or changes in wall characteristics. An analysis will be made to determine how the changes in the turbulent structure due to these perturbations will affect overall skin friction and radiated noise. The bursting phenomena will be studied at low (50 ft/sec) speed and at high (Mach numbers near 0.65) speed and at different boundary layer thicknesses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, UNSTEADY BOUNDARY LAYER FLOWS
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AF function - aerospace vehicles. Opportunity - of prime interest for the future will be the ability of the scientist and engineer to model flows with unprecedented accuracy, thereby minimizing the costly consequences of small errors in estimating the static and dynamic loads over a wide variety of shapes and configurations. The major communicating link between a body and the moving fluid in which it is immersed is the boundary layer. An important unresolved feature of this boundary layer is its stability and transition to turbulence in response to time-varying (unsteady) inputs such as might result from a maneuver. While the mean characteristics of the unsteady laminar boundary layer have been studied to some extent and are believed to be reasonably well understood, the transition of this laminar boundary layer to turbulence and the turbulent boundary layer which develops from this unsteady initially laminar flow have not been looked at in any detail. A unique way of studying, experimentally, the stability of unsteady viscous flows, particularly of transient as distinct from periodic flows, is by use of a Ludwieg tube as anticipated in this research effort. Objective - to study analytically and primarily experimentally the stability and transition characteristics of unsteady laminar wall boundary layers as well as the features of the turbulent flow at long times following passage of a finite wave over an observed measuring station in a Ludwieg tube. How work contributes - a major objective of this research effort will be to exploit the great flexibility of the expansion (Ludwieg) tube as regards independent variations of pertinent flow conditions which determine the basic similitude parameters.

The experimental program has concentrated on obtaining transition-time data by thin-film detection for a range of the parameters involved. It appears desirable to employ other diagnostic techniques as well. For that purpose a special hot wire probe is under construction and will be used to sense velocity fluctuations within the boundary layer itself. The theoretical investigation of the expansion wave boundary layer stability is based on a linearized small disturbance analysis using the method of multiple scales.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0034, ANTENNA RESEARCH
C.J. Drane, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904550)

AF function - communication and surveillance. Deficiency - antennas that are rendered ineffective for practical applications by their great expense, immobility, high drag coefficient, susceptibility to jamming, high sidelobe levels, low gain, and narrowbandedness. Objective - to provide fundamental technical basis for antennas that are cost-effective with more precisely predictable sidelobes; have high gain and easy pertability; are low profile with minimal aerodynamic drag; have wide angular scan capability; are significantly less vulnerable to enemy jamming; have sidelobes that can be selectively reduced; can operate in a dual frequency basis. How research contributes - provides antenna technology for OTH backscatter detection radars, emergency communications, high performance aircraft, aircraft-to-satellite communications, tactical surveillance, radiation defense of ground-based radar and communications systems, and broadband communications capability.

Judicious loading of array elements to significantly mitigate interelement mutual coupling; perturbative and iterative adjustment of dipole lengths and spacings along a transmission line whose characteristic and terminating impedances are also parameters in maximizing the gain; investigation of radiation mechanisms, basic element properties and bandwidth of microstrip antenna araays, surface wave concepts combined with phased array principles for high gain and efficiency over wide angles. Integrated design of reflector and offset feed for very low sidelobes; spatial filtering screens in immediate foreground of antenna arrays for selective reduction of sidelobes; short-backfire antenna structure combined with concentric loop for dual frequency operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0035, IN-HOUSE AMOS SUPPORT
D.W. Hanson, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF707210)

The objective of this effort is to characterize the micrometeorological turbulence environment at the ARPA

Maui Optical Station (AMOS). Program efforts aim at quantifying the atmospheric limitations imposed on optical propagation work.

Wavefronts propagating through the atmosphere suffer both phase and amplitude distortions. The origin of these random perturbations are local, small scale temperature fluctuations which produce variations in the index of refraction. Although phase distortions of an optical signal can create intensity fluctuations at a receiver, the average light intensity remains unchanged for any aperture larger than several centimeters. Image degradation is thus caused primarily by phase aberrations. To quantify these limitations on optical propagation work, we have installed an array of sensors which monitor both the meteorological and micrometeorological environment of AMOS. An all-sky camera gives us the data we need to develop clear-line-of-sight (CLOS) probabilities while more standard instruments provide a data base on wind speed, wind direcion, temperature, dew point, and pressure. The CLOS probabilities specifically address average intensity effects but provide no information on phase aberrations, to characterize these effects, we measure the temperature turbulence structure constant, C(sub T, squared) as a function of altitude above the site. The profiles, which we collect at various times of the day and year, enable us to calculate several propagation parameters. We compare these results with direct, independent optical measurements made at the same time the profiles were obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0036, COMPRESSOR/TURBINE INSTRUMENTATION AND TRANSIENT ANALYSIS EQUIPMENT

D.L. McCormick, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451960)

To purchase high response instrumentation and data acquisition and handling equipment for use in the in-house test programs.

Determine future instrumentation needs of turbine engine research testing. Purchase the most compatible equipment, design an operable system, supervise installation in rooms 17 and 21, and prepare operating instruction handbook. Conduct detailed performance tests of critical subsystems as installed and prepare AFAPL TR based on results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0037, CRF/J85 TRANSIENT INVESTIGATION

F. Ostdiek, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460550)

The primary objectives of this program are to determine the effects of speed transients on compressor performance, to obtain detailed information on compressor operating paths during transient operation, and to investigate the cause of compressor performance differences between transient and steady-state operation. This information will primarily be used to evaluate transient compressor test techniques for application to APL's CRF.

A J85-5 engine will be instrumented for transient compressor testing, the instrumentation will be interfaced with a modern computer II system for storage and processing of test data. An analysis of the data will be made in order to relate specific aerodynamic parameters to changes in performance that result during transient operation that can lead to compressor stall.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0038, SIMULATION OF THREAT MECHANISMS AND TERMINAL EFFECTS

C.D. Cruze, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141840)

This effort directly supports AFFDL/FESE test programs. Presently, there exists no launching system concerning conventional munitions capable of facilitating testing of foreign munitions other than the parent weapons. The objective of this program involves developing a common launching system to all small caliber foreign munitions and the techniques necessary to simulate their effects against U.S. aircraft. Accompanying the development of the foreign 'kill' mechanisms, efforts will be made to ascertain a means to defeat these threats.

Investigation of propellants will be conducted to ascertain the feasibility of combining powders for the purpose of controlling pressures and burn rates. This technology will be used to establish projectile velocities comparable to that achieved by exploding conventional missile warheads. Planned technological advances will be used to develop a family of weapons that will accept any foreign munition and duplicate the munition effect for test purposes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0039, ADVANCED ELECTRO-OPTICAL DISPLAY EVALUATIONS/APPLICATIONS

H.M. Dean, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143290)

This work unit supports TPO 3, Flight Control and Major Thrust and FG04, Flight Control Technology to Assure Flight Safety, Enduced Costs and/or Improved Maintainability/Reliability and Survivability. The function is to provide software and hardware for display evaluation studies. The problem area is the design of advanced military aircraft cockpit displayed on the incorporation of human factors criteria into format and symbology design and evaluation. The objective of this program is to generate a variety of display formats for various displays and to evaluate them using objective performance measures as well as subjective pilot opinion. Also, gray scale, refresh rate and perceptual disturbance due to motion will be investigated. The military relevancy is to provide the technology necessary to develop crew systems on future aircraft.

The approach is to conduct a comprehensive evaluation of display formats using both laboratory psychophysical techniques and subjective opinion data. Human factors personnel will design and conduct these studies and pilots will serve as subjects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0040, COMPUTATIONAL AERODYNAMICS

W.L. Hankey, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144650)

This work supports the A.F. Flight Dynamics Laboratory function of extending the technology base in aeromechanics. A deficiency exists in the ability to efficiently compute 3-D flow fields. The objective of this investigation is to develop three-dimensional numerical methods applicable throughout the flight corridor to solve governing differential equations of fluid mechanics. The current design technique for developing a new USAF system requires approximately 20,000 wind tunnel test hours, $50 million, and takes four years to accomplish. Use of numerical methods in the various design phases can dramatically shorten this cycle.

In the past decade remarkable advances have occurred in the numerical computation of fluid flows. Advances in both computation methods and computer hardware have made this progress possible. The approach will be to develop numerical codes to efficiently solve various forms of the Navier-Stokes equations on the advanced computers based upon the advances accomplished under Work Unit 2307N418.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0041, BOUNDARY LAYER TRANSITION ON STRATEGIC MISSILES

K.F. Stetson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136290)

The accuracy and weight of strategic missiles are influenced by the state of the boundary layer on the surface of the reentry vehicle. This results from the direct dependence of aerodynamic heating on the nature of the boundary layer and im-

pacts on the selection of the material, the determination of the thickness of the thermal protection system, and the vehicle shape change due to ablation. The objective of this investigation is to improve the technology base in the area of boundary-layer transition, giving emphasis to nose-tip transition and asymmetric frustum transition. This will lead to improved design criteria to minimize weight, hence reduce cost, and improve weapon performance.

An experimental investigation of boundary-layer transition is to be conducted in the AFFDL Mach-6 wind tunnel. The approach is to establish transition trends which will help the vehicle designer minimize the undesirable concave nose-tip ablation shapes and asymmetric frustum transition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0042, X-24B GROWTH VERSION

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The lack of sufficient flight research at speed between Mach 4 and 7 creates a technological deficiency which threatens the development of an adequate force structure during the next two decades. Definition of strategic and air superiority vehicles of the future will necessitate the availability of basic aerodynamic/aerothermodynamic criteria on which to predicate the high performance configurations. The growth version of the X-24B research vehicle will provide a low-cost/low-risk method of obtaining basic data directly applicable to these configurations. The specific objective of this effort is to complete the concept formulation activity necessary to support a joint USAF/NASA program for the design, manufacture and test of a derivative of the X-24B research vehicle and thereby produce a viable low-cost test bed to explore the aerodynamic/aerothermodynamic phenomenon inherent in high speed flight.

Approximately 94 hours of iron bird simulator flying time will be required to fulfill the pre-flight training requirements. Also, includes a minimum of 4 hours of cockpit time per pilot in the survivable flight control system test aircraft. Data acquisition includes time histories and film footage as related to stability/control and mission effectiveness evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0043, CHARACTERIZATION OF III-V SEMICONDUCTORS

D.C. Look, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF105310; F33615-76-C-1207)

There is a stated Air Force need for systematic evaluation and characterization of the electronic properties of the materials used in Air Force avionics systems. At present the electronic defect structure, surface and interface properties of these compound semiconductors used for microwave and opto-electronic devices are not well understood. The objectives of this contract are to identify and completely characterize the electronic defect structure of epitaxial and substrate compound semiconductors used in opto-electronic and microwave devices and to investigate the electronic properties associated with the surfaces and interfaces of the materials. Ultimate goal is to solve the material problems that affect the performance of the solid-state devices by conducting a thorough characterization study of materials, processes, and devices.

The objectives of this on site contractual program will be accomplished by gaining information regarding defect structure of the materials. Shallow or deep impurities and defects will be probed and identified by high-resolution bandgap photoluminescence, near and/or far infrared spectroscopy, and electrical transport measurements. Electron bombardment will be employed to identify intrinsic point lattice defects. The physical position of the traps with respect to the surface or interface will be deduced from C-V measurements, and the trap depth distribution is to be determined by C-V, thermally stimulated conduction (TSC) and thermally stimulated luminescence (TSL) measurements, as applicable for different samples. Spatially-resolved photoluminescence and x-ray topographic observations will be used to assist in determining the homogeneity of large samples. The results will be compared with electron-irradiated and ion-implanted materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0044, MICROWAVE PROPERTIES OF MAGNETIC DOMAIN STRUCTURES

S.H. Charap, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (ENG79-00900)

The microwave response of magnetic thin films or platelets containing a periodic domain structure (a bubble raft, for example) is being measured in weak magnetic fields in the frequency range 0.1-40 GHz. The samples, which are of the type commonly used to support magnetic bubbles, are characterized according to composition, thickness, saturation magnetization, anisotropy field, domain wall energy density and microwave damping factor. The domain structure is observed under conditions corresponding to those of the resonance experiments. Theoretical work is focused on a theory of the microwave behavior of magnetic thin films or platelets containing a periodic domain structure. The spatial variation of the static internal magnetic field within the domains is being taken explicitly into account.

This is a continuation of research previously supported under NSF grant ENG-7602057.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0045, IN-FLIGHT ACOUSTIC EMISSION (AE) RESEARCH

J. Carlyle, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN181020)

To develop and apply advanced acoustic emission data analysis methods using pattern recognition techniques to separate crack growth acoustic emissions from noise signals by waveform characterization. The purpose is to unambiguously detect fatigue crack growth in aircraft structures while they are stressed by the forces of flight maneuvers.

The program will consist of 3 phases comprising concept development system fabrication, and operational demonstration. Specifically, Phase 1 will develop an algorithm which can be utilized in future acoustic emission system designs to clearly identify those acoustic emission signals created by other processes. This phase will also estimate the probability of identifying crack growth acoustic emissions with the algorithm and evaluate this in light of economic and safety concerns associated with aircraft operation. Phase 2 will develop, fabricate and demonstrate in the laboratory a prototype in flight acoustic emission monitoring systems incorporating the technology developed in phase 1 for positive identification of acoustic emissions from fatigue crack initiation and growth. The system will be designed to function as an integral part of a selected aircraft during normal operational use. Phase 3 will perform an operational in-flight verification of the prototype monitoring system developed under Phase 2 to fulfill the overall program objective.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Sensors & Avionics Tech Directorate

4.0046, PULSED PLASMA THRUSTER PLUME CONTAMINATION

Unknown, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421117; F40600-77-C-0003)

The objective of this effort is to quantatively characterize the exhaust products from the one millipound (4.45mnt), teflon pulsed plasma thruster in order to determine the thruster's compatibility with spacecraft systems.

The feasibility of conducting quantitative measurements on pulsed plasma plumes will be determined by simulating a pulsed plasma plume in a small research vacuum chamber and identify the exhaust species. The optimum diagnostics and the most cost-effective baffling system will be determined for the AEDC cryogenic camber. If feasible, the millipound pulsed plasma

thruster will be tested in the cryogenic chamber and measurements made to identify the exhaust species and map the plume flow field, especially the backflow region.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0047, TRAJECTORY OPTIMIZATION FOR A *MIXED-MODE SINGLE-STAGE NUCLEAR SURFACE-TO-ORBIT* SHUTTLE

T.C. Powell, University of Tennessee, Central Office, Space Inst., Dept. of Mechanical Engineering, *Tullahoma, Tennessee* 37388 (DF055350; F49620-79-C-0166)

AF function - space defense. Opportunity - optimization of trajectory for a mixed-mode single-stage nuclear surface-to-orbit shuttle. Objective - research will be performed to obtain the characteristics of optimum trajectories of single-stage orbiting vehicles launched from the equator. How work contributes - future surveillance satellites may use single stage nuclear shuttles. To place a given payload in orbit the optimum trajectories for minimum initial mass are desirable.

Performance calculations will be performed for a single-stage shuttle operation. The engines will be designed to operate in two modes, a) low specific impulse propellants, and b) high-specific impulse propellants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, STUDIES OF COHERENT STRUCTURES IN TURBULENT SHEAR FLOWS

A.K. Hussain, University of Houston, Cullen School of Engineering, Dept. of Mechanical Engineering, *4800 Calhoun Blvd., Houston, Texas* 77004 (ENG78-22110)

A detailed set of turbulence structure experiments will be carried out. Included are: 1) Coherent structure of the circular jet; 2) Evolution of a turbulent spot in an axisymmetric free shear layer; 3) Coherent structure in high Reynolds number plane mixing layer; 4) Scale-dependent convection velocities in turbulent shear flows; 5) Antisymmetric excitation of a plane jet; 6) Free Shear-Tone phenomena.

All of these topics are related to aero-acoustic problems, jet noise, and to turbulent mixing problems in general.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0049, QUASI-OPTICAL TECHNIQUES FOR MILLIMETER AND SUBMILLIMETER WAVE CIRCUITS (16171-EL)

T. Itoh, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712 (DA0F9259; DAAG29-78-G-0145)

To investigate both theoretically and experimentally a class of dielectric transmission lines suitable for millimeter and submillimeter wave components and integrated circuits. Relevance: Results of the study are directly relevant to Army systems requiring low cost, reproducible millimeter wave components. Reviewers from MIRADCOM and ECOM mention applications to missile sensors and terminal guidance, radar for mini-remotely piloted vehicles and communications.

To utilize surface wave propagation guided on the interface between a dielectric slab and a dielectric strip as a building block for millimeter wave-integrated circuits. Particular emphasis will be placed on the utilization of grating structures within the guiding region to obtain (1) leaky-wave antennas and (2) high-Q band-pass and band-reject filters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0050, RESEARCH AND DEVELOPMENT IN *SPECKLE IMAGING*

J.W. Sherman, Analytic Information Processing Inc., *Danville, Virginia* 24541 (DF057500; F49620-80-C-0032)

AF function - surveillance and detection of spacecraft - this research effort will stimulate the use of speckle imaging techniques in gathering scientific and military image data with greater resolution than presently attainable. Deficiency - atmospheric seeing precludes the detailed observation of satellites and distant objects with ground based telescopes since passage through the turbulent atmosphere degrades the images. Objective - to understand and compensate for processes which degrade the coherence of light propagating through the atmosphere. Contribution - a capability will be developed to process atmospherically distorted images in order to obtain diffraction limited resolution of space objects from large aperture, ground based, optical systems.

An understanding of the statistical properties of the physical processes which degrade the coherence of light propagating in the atmosphere will be developed. The basic models on which speckle imaging is based will be developed and validated for both isoplanatic and non-isoplanatic conditions. The models of the statistics of the point spread response will be developed from the atmospheric turbulence models and validated with experimental data. The imaging model will be generalized to remove the optically narrow band assumption and make it an explicit function of wavelength. Models describing the effects of various sensors on the measured image will be improved. Equations will be derived to describe the second order statistics computed from a set of speckle images. Reconstruction algorithms will be developed. The accuracy of the performance of the reconstruction techniques will be analyzed in terms of image features and image error at each point. Images of solar filigree and magnetic structure, asteroids, binary stars and other astronomical objects will be reconstructed with improved resolution from the available atmospherically degraded imagery.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0051, INJECTION, ATOMIZATION, IGNITION AND *COMBUSTION OF LIQUID FUELS IN HIGH-SPEED* AIRSTREAMS

J.A. Schetz, Virginia Polytechnic Inst. & State University, *School of Engineering, Dept. of Aerospace Engineering, Blacksburg, Virginia* 24061 (DF029130; AFOSR-78-3485)

AF function - advanced airbreathing engines, external burning systems, weapon delivery and defense, transport. Deficiency -insufficient fundamental understanding of the problems associated with high-speed combustion phenomena in advanced practical combustor systems and lack of realistic guidelines for predicting injector/mixing system and combustor/propulsion system performance and operational characteristics and selection of acceptable liquid fuels. Objective - to formulate realistic analytical models describing the detailed physical and chemical processes involved in advanced turbojet and ramjet combustor concepts and external burning systems. How work contributes - will provide improved understanding and realistic analytical modeling of injection, breakup, mixing, vaporization and ignition phenomena not now available and will contribute to establishing guidelines and criteria for choosing acceptable fuels and in design and development of practical injector mixing systems and combustors of advanced engines, e.g., turbojet main-and after-burner, dump-vortex burners, dual-mode scramjet, and external burning systems.

Analytical and experimental studies will be carried out of penetration, breakup, atomization, ignition and combustion of liquid and liquid/solid particle slurry fuel jets injected across a high-speed air stream in subsonic, transonic and supersonic facilities at various Mach numbers, and including conditions associated with subsonic dump combustors, supersonic combustors and external burning. For the liquid fuel jets, emphasis will be on detailed experimental studies of droplet size variations along and across the plume of the liquid jets as a function of injector port size and shape, injectant flow rate, viscosity and surface tension. For the slurry fuel transverse jets, the effect of particle loadings and particle sizes in the liquid jets will be investigated. The penetration and distribution of both phases will be determined. Breakup of the jet column will be studied, and droplet sizes will be determined. Flow fields, atomization, vaporization and diffusion rate and ignition and combustion details will be determined employing nanosecond photos, streak photos, high-speed motion pictures and thermographic infrared photography.

Particle size and distribution will be determined using laser light scattering. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, RESEARCH ON FLOW PHENOMENA RELATED TO HIGH POWER LASER

W.H. Christiansen, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, 206 *Guggenheim Hall, Seattle, Washington 98105 (DF053980; F49620-79-C-0020)*

AF function - high energy lasers. Opportunity-improve our understanding of the flow phenomena associated with modern high-power continuous wave gas lasers. Objective - develop new fundamental concepts for the interaction of laser radiation with flow and search out new approaches to improve performance. How work contributes - detailed quantitative understanding of fluid flow-laser radiation interaction will allow design tradeoffs which optimize high power gas lasers' performance.

A combined analytical and experimental program is being conducted. The proposed work will include the study of the interaction of the aerodynamics and discharge phenomena in flow lasers, the study of fluid optics involving the use of flow as an optical control element, a study concerned with the phenomena involving shear layers in nonequilibrium and reacting gases in a lasing cavity, and a study on pressure recovery systems applicable to lasers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0053, THE NON-LINEAR AERODYNAMIC CHARACTERISTICS OF FINNED SLENDER BODIES AT HIGH ANGLES OF ATTACK

J. Rom, Technion, Research & Development Foundation Ltd., *P.O. Box 4910, Haifa, Israel* (DA0D9374; DARRO-78-G-0021)

The objective of the research program is to study the nonlinear aerodynamic characteristics of slender bodies at high angles of attack both in the normal and in the lateral directions. The development of a method for evaluating these aerodynamic characteristics, and an experimental program which will result in a better understanding of methods for influencing the position and strength of the shed vortices at high angles of attack will be accomplished.

The experimental program will include the following areas: (1) Visualization tests in a subsonic wind tunnel for flows over slender sharp and blunt ogive-nosed clyindrical bodies with and without canard fin configurations. Tests will be conducted at angles of attack up to 90 degrees. (2) Introduction of blowing ports or small streaks to effect the position and strength of the vortics and their interaction on the body. (3) Measurements of the six components of the static aerodynamic forces and moments on selected configurations at transonic and supersonic speeds at angles of attack of up to 50 degrees and 80 degrees. The calculation method will include: (I) Review of the methods for prediction of boundary layer separation position on slender configurations. (II) Development of a computer program which will include the computation of the vortices strengths and positions and, by an interactive procedure, evaluate the flow configuration and the non-linear aerodynamic characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0054, FAST ION TRANSPORT IN SOLIDS

A.V. Chadwick, University of Kent, *Canterbury, England, United Kingdom* (DF049790; AFOSR-77-3427)

AF function - power generation and distribution is required for the operation of the electrical equipment for increasing inflight speed and performance. Deficiency - need for information of the basic mechanisms of solid electrolyte type materials used in battery and fuel cell technology. Objective - to develop fundamental information about the basic mechanisms of ionic transport, the point defect structure and self-diffusion parameters in solid-state electrolyte materials. How work contributes - results will provide important basic information on fast fluoride ion diffusion, and increase the potential for discovery of new fast ion conductors. Application of devices using these materials will provide advantages of longer working temperature range, long 'shelf-life', and easy miniaturization.

Conductivity-NMR techniques as to be employed to study ionic transport in three types of fluorides which exhibit fast ion conduction. The three types of materials are described as rare earth fluorides, tysonite-related fluorides, and mixed fluorides. Through the application of various techniques, the following data will be obtained - accurate diffusion parameters for the constituent ions, identification of the mechanisms of diffusion, information on the point defect structures, and the relevance of the phase transitions and their effect on ionic transport. The results and interpretations will be particularly relevant in solid-state technology and in ion transport in high temperature insulating materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, A STUDY OF MAGNETIC AND AURORAL DATA FROM THE IMS ALASKA MERIDIAN CHAIN OBSERVATORIES

S.S. Akasofu, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM79-02953)

Magnetic and auroral data from the International Magnetospheric Study (IMS) Alaska meridian chain of observatories have been processed. A preliminary study of the data indicates that the quality is excellent. In particular, the meridian chain data reveal intense magnetic 'fluctuations' in the vicinity of the cusp region. On the basis of the IMS Alaska meridian data and of other IMS chain data, a number of specific studies will be investigated including some of the most important problems associated with magnetospheric physics. They include the polar daily magnetic variations on extremely quiet days and the modulation of them by the interplanetary magnetic field (IMF) variations, the electric current systems associated with the cusp region, contracted oval substorms, the Harang discontinuity, and substorms.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, INVENTORY AND CLASSIFICATION OF WINDFORMS

C.S. Breed, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02366)

Work planned includes: 1) Completion of geomorphic sketch and index maps showing distribution of Martian windforms; 2) Preparation of figures and captions; 3) Writing of the text for an Atlas of Windforms on Mars for submission as a NASA Special Publication.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, IMAGE PROCESSING

H.H. Kieffer, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-00991)

Development and coordination of a wide variety of advanced image processing techniques. Development of techniques and a hardware system for efficient transformation of information in map format into a digital data base. Establishment of planetary science consortia consisting of information from many types of investigations in a standard format. Geometric transform support for digital cartographic, photogrammetric and radar studies. Most of these efforts are of a continuing nature, consisting of development of specific techniques as required. The map digitization project should be largely completed in this

fiscal year and organization of lunar consortium will be completed in this fiscal year. The Martian data consortium should be defined and the scientific data in hand processsed during the fiscal year; this consortium should be smoothly operating by the end of the fiscal year.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, REMOTELY SENSED TURBIDITY

B.M. Herman, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN624031; N00014-76-C-0438)

The objective of this research is to develop a radiation transfer model of the atmosphere general enough so that it will apply to broken and optically thick cloud situations. As part of the radiation transfer problem, it is also a research objective to develop solar radiometry techniques to determine the aerosol loading of the atmosphere. This research will have application to improvement of numerical weather prediction and to the development of laser techniques (under an allied contract) for measurement of the size distribution of particulates in the atmosphere. This latter development is in support of naval weaponry employing electrooptic guidance techniques.

In the conduct of this research various sensitive radiometric techniques are employed of both direct and diffuse radiation. Solar radiation is observed at various sun angles and in various parts of the spectrum. A considerable portion of the effort is devoted to the developement and improvement of numerical models that apply to more general cases and that are economical enough of computer time for frequent use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, MODELING ECOSYSTEM IMPACTS OF CLIMATIC CHANGE FROM ENERGY DEVELOPMENT AND USE

C.F. Cooper, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Biology, *5402 College Ave., San Diego, California* 92115 (106175 TICNO; 008080)

An assessment and evaluation will be made of theories and techniques for predicting ecological effects of climatic change resulting from accelerated energy development. Emphasis will be on the influence of climate on primary and secondary productivity and on the structure and distribution of ecosystems. The research is expected to lead to an improved ability to predict ecological consequences of climatic change. Emphasis will be on simulation and statistical models, field and laboratory observation and experimentation, and paleoecological studies. Particular attention will be given to the level of aggregation in ecosystem-climate models and to the potential role of satellite observations. The principal product of the research will be a carefully documented monograph on modeling ecosystem-climate relationships.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0006, NAVY ENVIRONMENT - INFRARED ATMOSPHERIC PROFILING

C.R. Claysmith, General Dynamics Corp., Convair Aerospace Division, *P.O. Box 1950, San Diego, California* 92112 (DN575314; N00014-75-C-0940)

Operation of Navy aircraft near the sea surface and naval combatants on the sea surface required accurate and timely environmental information which will allow the operational commander to fully assess his options. The paucity of available environmental information over the oceans compounds the Navy's problem of accurately forecasting atmospheric conditions. An infrared profiler could provide a reliable easily maintained, automatic, remote sensor for the measurement of water vapor and temperature in the vertical from the surface up to 6 km.

The remote infrared atmospheric profiling system (RIAPS) is presently at the contractor's facility. He is installing new detectors, calibrating the RIAPS and acquiring test profiles. The system is then to be installed and maintained at PMTC, Pt. Mugu, Ca. for a three-month field test.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, GROUP DELAY MEASUREMENTS OF IONOSPHERIC PERTURBATIONS

C.L. Rino, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF584010)

AF function - satellite ranging and navigation systems. Deficiency - ionospheric perturbations severely limit the accuracy of advanced surveillance and navigation systems. Objective - to develop new experimental capability and to make new measurements of the ionospheric group path delay under conditions of ionospheric disturbances. How research contributes - payoff will be through new observations of absolute group path delay, the direct parameter limiting accuracy of advanced ranging systems. These results will contribute to enhanced AWS capability to provide improved ionospheric time-delay forecasts to advanced systems customers.

New measurements of the equatorial and high latitude perturbed ionosphere will be made using the group path delay technique. Dual frequency signals from the NAVSTAR-global positioning system satellites will be received from a newly designed receiving and digital detrending system to be implemented for the first time with these measurements. Expected large latitudinal and temporal gradients in time delay directly across the magnetic equator and at very high latitudes will be observable for the first time with this new system. A series of measurements in both regions will be undertaken to parameterize the temporal and geographic extent of the large differences from present predictable ionospheric behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, STUDY OF AEROSOL EFFECTS ON SOLAR RADIATION USING LIDAR AND AN INSTRUMENTED TOWER

P.B. Russell, S R I International, Atmospheric Sciences Laboratory, *333 Ravenswood Ave., Menlo Park, California* 94025 (ATM78-02704)

The objectives of this study are to improve our understanding of the role of aerosols in modifying climate. This will be achieved by monitoring the changes in the atmospheric albedo while simultaneously documenting particle concentrations and characteristics. Radiative models will be used to interpret the measurements.

The study includes continuous measurements of upward and downward solar irradiance above the urban-coastal haze layer using a unique tower facility at Sutro Tower, LIDAR documentation of haze structure, numerous radiometric measurements near the surface.

The plan includes two field programs at the Sutro Tower and adaptation of an advanced radiative transfer code for simulation of measured incidents. It also includes participation in a joint marine field program with the University of Arizona. At the end of the two-year program all measurements and analyses will be unified in terms of aerosol models and parametric radiative effects that will be published in a form readily usable by other climate modelers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, ENVIRONMENTAL DISTURBANCE EFFECTS ON IONOSPHERIC (PART OF BLOCK PROGRAM FOR EM/EO PROPAGATION)

P.E. Argo, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN034000)

Develop near earth environmental disturbance forecast and normal propagation prediction models which use real time satellite borne remote solar and ionospheric sensors to assess and predict propagational constraints on the performance of military

communications, navigation, surveillance and signal exploitation systems. Provide model development support which reflects the latest state-of-the-art in real time environmental assessment and prediction for the 6.5 advanced Prophet program.

Using the latest geophysical knowledge, algorithms will be developed which, either explicitly or implicitly, accurately emulate the dynamics of the ionosphere. Research from the worldwide ionospheric community will be reviewed and utilized where possible to produce the theoretical and applied models along with the software to test and verify them.

SUPPORTED BY U.S. Dept. of Defense, Naval Material Command, Technology Div.

5.0010, NAVAIR RESEARCH CHAIR IN METEOROLOGY

G.J. Haltiner, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN098058)

The purpose of the research chair is to provide a strong interaction between NAVAIR and NPS with regard to meteorological research of particular relevance to the Navy and to stimulate the professional development of students and faculty in the area of expertise of the incumbent(s) of the chair.

The research chair will be occupied by Dr. H. A. Panofsky, Dr. D. Gaver, Dr. F. Baer and another person to be named later. The research areas to be addressed are: (1) the improvement of dynamical-numerical forecasts by applying statistical methods to the model output parameters to eliminate any systematic errors due to model deficiencies and geographical pecularities; (2) the relation of white cap distribution to predicted or analyzed surface wind and static stability fields using both statistical and physical reasoning; (3) the application of theoretical and empirical methods to relate atmospheric turbulence to the surface wind and temperature structure and to electro-optic propagation; and (4) the use of a nonlinear normal mode method to filter observed data for use as initial fields in numerical weather prediction model with the primary purposes of filtering undesirable noise and providing more realistic initial conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0011, IDENTIFICATION AND INTERPRETATION OF SMALL-SCALE VOLCANIC FEATURES ON MARS

C.A. Hodges, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02356)

Plans for the current fiscal year are centered primarily on further investigation and analyses of the landforms of probable volcanic origin unique to each of the provinces thus far identified on Mars. Topographic measurements are essential for adequate geomorphic interpretation and it is hoped that such measurements can be obtained from Viking photographs by photogrammetric or other means. Detailed comparisons with appropriate terrestrial analogs will provide bases for speculations on physical and chemical characteristics of the Martian features. Investigation of cinder cone morphologies in the San Francisco volcanic field (Flagstaff, Arizona) will continue.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0012, AERIAL PHOTO SPECIFICATIONS FOR FORESTRY

R.N. Colwell, University of California, Berkeley Campus, Agricultural Experiment Station, Dept. of Forestry & Conservation, *Berkeley, California* 94720 (0010844; CA-F#-FRU-1329)

OBJECTIVE: Determine, for forested areas, the type of aerial photography from which information essential in the practice of forestry can be most accurately and readily extracted.

APPROACH: The work will be designed so as to permit a determination of the relative ease and accuracy with which forest composition, vigor, density, size, age structure, and land features can be recognized on photography taken with various film-filter combinations, at various scales, and at various times of the day and year. Spectrophotometric analyses of the objects and conditions to be identified will first be made, in order to select the film-filter combinations which theoretically will provide the best photographic tone or color contrasts. Aerial photography of representative forest areas will then be flown with the selected film-filter scale combinations at various times of day and year. Through photo interpretation, estimates will be made from each set of photos as to forest conditions existing within the test areas. The accuracy of the interpretations will be determined by field checking, so that the specifications for optimum forest photography can be formulated.

PROGRESS: In June, 1978, multiband photography was obtained from an altitude of 21,000 meters above the terrain through the use of a NASA-U-2 Aircraft as it flew over our remote sensing test sites in Mendocino County, Calif. The following 3 film-filter combinations were employed: Panchromatic film with a Wratten 12 filter; Infrared Ektachrome film with a Wratten 89B filter; and Aerial Ektachrome film with an HF-2 filter. For this purpose 3 identical cameras were operated simultaneously, each having a 12-inch focal length and a 9" x 18" negative size. From a light aircraft operated at 500 meters above the terrain we also took simultaneous photography of selected portions of the area, using the same 3 film-filter combinations. From our comparative interpretations of these 3 combinations we conclude that: The Infrared Ektachrome photography is superior for mapping fuel conditions in brushfields and selecting the specific areas within which fuel modification measures might best be employed such as prescribed burning, mechanical removal of brush, etc. (Text Abridged.)

SUPPORTED BY California State Government

5.0013, NORTH PACIFIC EXPERIMENT (NORPAX) - STUDIES OF EQUATORIAL DYNAMICS AND LONG PERIOD TRANSPORT VARIATIONS IN THE CENTRAL PACIFIC

R.A. Knox, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (OCE78-23134)

This project is part of the North Pacific Experiment (NORPAX). The long-range goal of NORPAX is to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space in excess of 1,000 kilometers, and the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of this goal should eventually lead to improved weather/climate prediction for both the Pacific Ocean and North America.

A major component of NORPAX is a coordinated field program to determine the space and time variability of the density and velocity fields in the upper layers of the Equatorial Pacific current system. This field program will involve the efforts of a number of scientists. Measurements will be made from ships, airplanes, and moored and drifting instruments.

This grant will provide for current meter measurements from three moorings on or near the equator at about 153 degrees W. Five current meters will be placed in the upper 250m of water on each mooring. The moorings will be deployed and retrieved.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0014, DEVELOPMENT OF A MESOSPHERE-STRATOSPHERE-TROPOSPHERE RADAR SYSTEM

B.B. Balsley, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (ATM78-17327)

A series of recent developments point to the exciting possibility of using large VHF radar systems to examine the atmosphere at altitudes between 1-100 km. Such radars measure the total wind vector, wave motions and a variety of turbulence parameters on a continuous basis. The determination of total wind modes, the effects of atmospheric waves, and the importance of turbulence processes as a function of height in the troposphere, stratosphere and mesosphere are of considerable interest in our attempts to fully understand atmospheric processes. Thus, the radar technique when it has been fully developed - promises to be an invaluable tool for atmospheric research.

This grant funds the construction of a prototype radar to be dedicated solely to atmospheric studies below 100 km. Its operation is also expected to provide key guidance for development of a second-generation facility based upon results obtained from the initial system. The prototype system will be located near Chatanika, Alaska, which offers unique opportunities for comparative/correlative observations by independent techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, REMOTE WAVE & CURRENT SENSING

D.E. Barrick, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (DN075474; N00014-80-C-0066)

This work will be the analysis of radar data taped during the Marsen experiment. The analyzed and refined data results will be provided to other U.S. participants in Marsen for ground truth. Intecomparisons of these data with other in situ and radar data also will be made.

Approximately 600 hrs. of computer time will be required to reduce these data. The work will be accomplished with existing computer software and numerical techniques already developed for this radar. New methods of analysis will also be developed to extract the maximum data from these records.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0016, DUAL-CHANNEL RADIOMETRY

F. Guiraud, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (RAA76946)

OBJECTIVE: To construct a dual-channel (20-30 GHz) radiometer with full-sky coverage for measurement of water vapor and cloud liquid; for measurement of absorption by vapor, and research in cloud observations and weather modification.

CURRENT YEAR PLAN: To complete construction and test on the mobile platform, to calibrate at WSFO Denver, and to operate in weather modification and microwave absorption programs.

PROGRESS: Construction of the electronics of the radiometer is complete and initial tests have been performed. Construction of the antenna assembly and mounting on the mobile platform are near completion.

SUPPORTED BY Arnold Research Org. Inc.

5.0017, NATIONAL AEROMAGNETIC SURVEY

R.H. Godson, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9730-00352)

To administer and technically monitor new contracts to private industry for airborne surveys. To continue compilation of state maps of Alaska and Hawaii, in color. To edit and update the computer base of principal facts of airborne surveys. To devise new and better methods of data processing of geophysical data and to develop a generalized system of computer programs and procedures to allow an easy flow of geophysical data from initial reduction through data analysis and display.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0018, REMOTE SENSING STUDIES IN SOUTHEASTERN MISSOURI

D.H. Knepper, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02247)

STATES TO WHICH PROJECT PERTAINS: Missouri, Illinois, Arkansas.

Preparation of a tectonic map of southeastern Missouri will be completed and a manuscript detailing the tectonic setting will be prepared. A manuscript detailing lineament and morphometric analyses of the Rolla 2-degree quandrangle will be prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0019, OBSERVATORIES

J.D. Wood, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-01275)

STATES TO WHICH PROJECT PERTAINS: Alaska, Colorado, Virginia, Arizona, Texas.

Magnetic observatories will continue to record the strength and direction of the Earth's magnetic field. The recording will be continued at Barrow, College, and Sitka, Alaska; Boulder, Colorado; Fredericksburg, Virginia; and Tucson, Arizona. New magnetic observatories will begin operations at locations near Fresno, California; in Starr or Duval County, Texas; and under cooperation with the Office of Earthquake Studies and the USGS Mission in Saudi Arabia near Taif. Under Project 9920-00193, magnetic observatories will also be operated at Guam, Newport, Washington and San Juan, Puerto Rico. The Honolulu observatory will continue under the National Oceanic and Atmospheric Administration.

The data are collected, processed and deposited in the World Data Centers for worldwide distribution. Within the Survey, and by other users worldwide, the data are used in studies of mineral exploration, space physics and solar/terrestrial relationships, navigation, surveying, telecommunications, and for developing a better understanding of the processes occurring in the crust and mantle of the earth. The primary users are in magnetic charting and secular change studies.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0020, ATMOSPHERIC POLLUTION SCAVENGING

R.G. Semonin, State Water Survey, *605 E. Springfield Ave., Box 232, Urbana, Illinois* 61820 (6440; EY-76-S-02-1199)

The objective is to determine the importance of cloud and precipitation processes in the transport and removal of airborne aerosols. A 5-year measurement program was concluded in August 1975. The measurements were obtained as part of the St. Louis Metromex Project on inadvertent weather modification. The continuation of this work will include: (1) final analysis and interpretation of all collected data for the Metromex final report; (2) preparation of a preliminary design for field participation in the multistate atmospheric power production pollution study; and (3) the establishment of a baseline precipitation chemistry station.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0021, MET AND MATH ANALYSES

A. Gerlach, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (DF582220; F19628-79-C-0033)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information and techniques to satisfy military weather support requirements. Objective -(T2310G2) determine the most appropriate numerical weather prediction model resolution for a given initial observational density. (T667007) Develop real time radar diagnostic software for a minicomputer operated on-line with an advanced Doppler weather radar. (T667008) Develop techniques for applying digitized meteorological satellite imagery data to short range (0-6 hrs) weather forecasting. Improve the output of the AFGL/LY man/computer interactive data access system (MCIDAS) to support development of techniques in satellite meteorology. (T667010) Evaluate the temporal and spatial characteristics of critical aviation weather parameters and develop descriptive display methodologies. Develop mesoscale (0-6 hrs) objective weather prediction techniques for critical aviation weather parameters. How research and development contribute -provide improved weather analysis and forecasting techniques in (T2310G2) mathematical models of atmospheric processes. (T667007) Improving the utility of advanced Doppler radar. (T667008) Improving DMSP satellite imagery and techniques

for using MCIDAS. (T667010) Development of real time use of advanced weather systems and automated weather forecasts and warning techniques.

(T2310G2) Analytical and numerical techniques will be applied to problems in atmospheric dynamics. (T667007) Develop the following -software, for pattern recognition, real-time estimation of horizontal wind speed, direction, and convergence or divergence based on quantitative measurements from a single Doppler weather radar, the operational identification and prediction of damaging winds. (T667008) Acquire, navigate and archive samples of digitized satellite imagery data, correct data for various system errors and analyze in conjunction with other meteorological data. (T667010) Test and improve a prototype modular automated weather system (MAWS) using data acquired at the AFGL field facility.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Meteorology Div.

5.0022, THE RESOLUTION CAPABILITY OF THE SEASAT-A RADAR ALTIMETER

R.F. Brammer, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (K7-936; NA79SAC00785 MOD.#1)

OBJECTIVE: Implement and test a matched filtering algorithm for processing SEASAT data to detect occurrence of seamounts; to demonstrate performance of this filter by using both simulated and actual SEASAT data; to determine resolution capability and uncertainty in the estimation of seamount location and size, and to compare detection capabilities of the 0.98 Hz and 9.8 Hz SEASAT data.

APPROACH: A parametric model will be used for SEASAT data and the geoid signatures for a range of different size seamounts. The minimum size seamount signature that can be detected for 9.8 and 0.98 sample/second data will be determined. Preprocess SRD data to check data quality, remove blunder points and produce plots of data time series and filter output. Tables and maps of indicated detection will be compiled. The resolution capability of filtering method will be determined by investigating detectability of small seamount signatures added to real data. The accuracy attainable in estimating seamount size and location will be studied and a comparison made of computed detection and false alarm probabilities with results actually obtained with SEASAT data.

CURRENT PROGRESS: Seasat radar altimeter data is capable of resolving geoidal features with characteristic wavelengths of 70 km or greater with very high accuracy and some capability for resolution of features having wavelengths as short as 30 km. More analysis is required in order to develop an understanding of the regional variation of resolution capability. A paper 'Preliminary Estimates of the Resolution Capability of the SEASAT Radar Altimeter' will be published by Geophysical Research Letters.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Earth Satellite Service

5.0023, A STUDY OF THE ROLE OF ELECTRIC FIELDS IN THE DYNAMICS OF THE SOLAR CORONA

P.V. Foukal, Atmospheric & Environmental Research Inc., *872 Massachusetts Ave., Cambridge, Massachusetts* 02138 (AST79-23232)

It is proposed to study the observational and theoretical evidence for large-scale electric fields in the solar corona. Specifically, it will be investigated whether quasi-static electric fields may promote significant mass and heat transport across magnetic field lines in the outer solar atmosphere. By observing the linear Stark effect in the Balmer radiation from relatively cool (approximtely 10,000 degrees K) plasma found in many coronal loop structures the electric fields and motions can be investigated directly. The data to be analyzed are the coronal spectra which have been obtained over many years with the 16' coronagraph and universal spectrograph at the Sacramento Peak Observatory. Additional spectra will also be taken during the upcoming solar maximum and observations will be coordinated with other ground based and Solar Maximum Mission spacecraft-based programs.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

5.0024, ATMOSPHERIC DENSITY MODELS INCLUDING TIDES

J.M. Forbes, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF246720; F19628-79-C-0088)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - development of improved models of the thermosphere including the effects of tides and test and evaluation of model atmospheres for use by COESA and Air Force operational organizations. How research contributes - new models, which will include work done on this contract, can be recommended for use by the NORAD Cheyenne Mountain Space Computation Center and by COESA in the development of revised US standard supplements.

A multiple linear regression (MLR) model of the thermosphere will be compared with an independent set of observations, the Jacchia (1977) empirical model and the MSIS model. A complete hybrid observational-theoretical wind model will be developed for consideration by COESA. Evaluation of the MLR model's ephemeris prediction capability will be made using data from Doppler beacon, OV1-17, OV1-21 and more recent satellites. Appropriate recommendations concerning the new models will be made to COESA and ADCOM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SATELLITE RADIATION DOSIMETER

Unknown, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF581660; F19628-78-C-0247)

AF function - navigation, communications and surveillance. Deficiency - inaccurate environmental specification for radiation hardness of microelectronic components will result in inefficient design criteria for military satellite systems. Objective - acquire a high energy (1-10 MEV) electron radiation dosimeter for satellite measurements. How research contributes - direct measurement of the radiation dosage due to the high energy electron spectrum is needed to resolve uncertainties in calculations of radiation hardening requirements.

A radiation dosimeter will be designed, fabricated, tested, calibrated and launched aboard a DMSP satellite to measure the specific radiation encountered by a specific target due to electron (1 -10 MEV), protons (greater than 20 MEV) and the effects of nuclear interactions on a solid-state detector.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, AURORAL CORRELATION STUDIES

G. Davidson, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF582620; F19628-79-C-0066)

AF function - infrared optical detection systems. Deficiency - lack of knowledge of auroral atmospheric processes controlling infrared backgrounds. Objective - correlate visible and infrared emission measurements of auroral backgrounds. How research contributes - an analysis of existing auroral data will provide insight into the spatial and temporal characteristics of auroral backgrounds which can effect surveillance systems.

Calibrate, analyze, and correlate auroral data measured by a DMSP satellite, ground based photometers, and aircraft all-sky cameras. By comparing simultaneous data from these sources, a spatial/temporal model of infrared auroral emissions can be inferred from known visible auroral structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, IONOSPHERIC REFRACTION FOR DEEP SPACE SURVEILLANCE RADARS
R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580880)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of ground based and satellite radars which detect and track deep space targets is severely limited by ionospheric effects. The normal variability of the ionosphere causes target signal phase to vary so rapidly that present and proposed radars can only integrate coherently for small samples of 10 to 100 seconds. Objective - develop a technology to support ADCOM requirements for deep space systems, tailored to the range extension modification of SPADATS radars and to the deep space surveillance radar system. How research contributes -increases the sensitivity of radar detection and tracking in deep space so that tradeoffs can be made between system performance and costs. Provides a technique to use local measurements of changes in the ionosphere so that AWS predictions of median ionospheric conditions can be adapted to the real time conditions in the attack corridors. This will make the range extension feasible at existing ADCOM radars. Provides design and development technology for the follow-on deep space surveillance systems for use in preliminary design and system development. Investigate time rate of change of ionospheric refractive effects for deep space surveillance systems, using existing AFGL models of electron density profiles and of ionospheric parameters. Develop and validate computer algorithms so that the Air Weather Service can provide a monthly median prediction of refractive effects for deep space radars. Develop adaptive techniques to use real-time local radar and ionospheric measurements to correct for the hour-to-hour variability of the ionosphere. Determine the optimum grid of local observations and the optimum interval between updates to meet the performance requirements over the system field of view.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, REGIONAL MESOSCALE CLIMATOLOGY
I.I. Gringorten, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584320)

AF function - planning military operations. Deficiency - the capability to estimate weather conditions over targets, battlefields and denied areas where weather observations and climatological data are not available. Objective - to distinguish climatic variations over a region as a function of geophysical features such as topography, nearness to water bodies, and vegetation. How development contributes - improved regional mesoscale climatology will provide decision makers with more detailed weather information for operational planning.

Ceiling, visibility, wind hydrometeors, temperature, and humidity data will be collected for selected regions where suitable data are available. These data will be analyzed to determine mesoscale climatic distribution. Techniques will be developed for specifying these distributions as a function of geophysical influences.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ULTRAVIOLET SURVEILLANCE BACKGROUND MEASUREMENTS
R.E. Huffman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581300)

AF function - target detection, surveillance, attack assessment, tracking, communications. Deficiency - insufficient information concerning the spatial and spectral variability and magnitude of the global vacuum ultraviolet (VUV) radiation background. Objective -measurement with satellite sensors of the intensity of the VUV background, its spatial and spectral variation, and its correlation with ionospheric, solar, aeronomic, and auroral parameters. How research contributes - the background radiation from the Earth's atmosphere must be known in detail for use with missile target intensities in the design and evaluation of new surveillance systems capabilities and for selecting optimum wavelength bands. Improvement in communications system operation will be possible following validation of indicated correlations of VUV radiation with ionospheric critical frequencies and auroral zone locations.

The global VUV radiation levels will be measured with the satellite experiment CRL-246, Vacuum Ultraviolet Backgrounds. A spectrometer will provide resolution in the range 1050-3100 angstroms, and a photometer will provide spatial resolution comparable to systems resolution. The experiment will be flown on Space Test Program Flight S77-2.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, ARTIFICIAL AURORAL SPATIAL EXPERIMENT
R. O'Neil, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584510)

AF function - infrared optical detection systems. Deficiency - lack of knowledge of the optical and infrared emissions induced by the detonation of a high altitude nuclear weapon. Objective - to measure the spectral (0.2 - 25 microns) emissions induced in the night atmosphere by a high-power (120 kW) rocketborne electron accelerator. How research contributes - this experiment measures the spectral nature of the atmospheric emissions induced by a rocketborne electron accelerator under controlled input-output conditions. On a very limited energy deposition the dosing conditions simulate the energy deposition magnitudes of the x-ray and beta-rays of a nuclear detonation.

The EXCEDE spatial experiment consists of a high-power electron accelerator, 120 kW (3kV, 40 amperes) and a number of ultraviolet, visible and infrared spectral instruments launched in a mother-daughter experiment configuration. The sensor payload (daughter) is deployed from the accelerator with both payloads oriented in a prescribed manner and the electron source activated in a controlled pulse format that continues for the two-minute duration of the experiment. Spectra are recorded by both rocket- and ground-based sensors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, S3-TRAPPED PROTON FLUX MEASUREMENT
A.G. Rubin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248920)

AF function - reliability, cost-effectiveness, lifetime and survivability of operations space systems. Deficiency - knowledge of the energetic particle environment necessary to adequately predict the reliability and lifetime of space systems. Objective - to determine the transient- and steady-state energetic particle environment and to indicate possible effects on spacecraft performance and lifetimes. How research contributes - an extended data base from AF satellites will be used to construct realistic static and dynamic models of the near-earth particle environment.

Data from the S3-3 satellite currently on magnetic tapes will be sorted according to magnetic field, location, and time. After background correction, particle population will be compared to previously available data. Since S3-3 data is collected from higher altitudes than previous satellites, data will be available for some regions and at same energy ranges not previously available. For previously unobserved phenomena, comparisons will be carried out employing magnetospheric dynamical theories.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, SATELLITE MEASUREMENTS OF SOLAR ACTIVITY MAGNETISM AND MOTIONS
G.W. Simon, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584740)

AF function - communications, surveillance, detection, tracking. deficiency - inadequate knowledge of fine-scale solar features and physical parameters observable only in the extreme ultraviolet and x-ray portions of the solar spectrum prevents their use in predicting the occurence of solar events that disrupt

or degrade AF systems. Objective - to use satellite observations from the NASA Solar Maximum Mission (SMM) satellite (launch date Nov 79) and the Space Shuttle Spacelab 2 mission (Sl2) (to be launched Jan 82) to observe those pertinent solar parameters which are inaccessible to ground-based observers because of absorption and turbulence in the Earth's atmosphere. How research contributes - these observations will be combined with data obtained simultaneously with ground-based telescopes to give the most accurate representation to data of solar flares, activity, magnetism, and motions. These observations will be analyzed in an attempt to develop a cohesive and reliable model for flare prediction.

The SMM will have a number of instruments which operate in the EUV and X-ray bands. AFGL/PHS personnel are guest investigators on SMM, as is a PHS contractor at the University of Colorado. They will observe the sun in optical wavelengths simultaneously with SMM using specialized instruments at Sacramento Peak Observatory which are not available on the SMM spacecraft. Since SMM is being flown at the maximum of the solar activity cycle, it is expected that many flares will be observed, and that these will lead to new and useful techniques for predicting geophysical disturbances of solar origin. Two PHS personnel are also co-investigators on the Lockheed Solar Optical Universal Polarimeter (SOUP) experiment on Sl2 which will obtain the highest-resolution data ever obtained of solar magnetic and velocity fields. These observations should indicate whether knowledge of the very-fine-scale structure, unobservable from the ground due to atmospheric turbulence, is critical to our understanding of transient phenomena in active and quiet regions of the solar surface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, EVALUATION OF DMSP WATER VAPOR RADIANCES

F.R. Valovcin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583100)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - inability to determine meteorological variables over inaccessable or unfriendly territory. Objective - to recommend operational techniques to derive moisture parameters from DMSP radiance measurements. How research contributes - water vapor obtained from satellite radiance measurements as input into AFGWC's objective analysis program, Cloud Model, 3DNEPH and numerical forecasting model should provide an improvement in the analysis and forecasting of meteorological variables for AF tactical and strategic operations, weapons and surveillance systems.

DMSP water vapor radiances (emissions) will be correlated with ground truth measurements from polar to equatorial regions and for different seasons. In addition, comparisons of calculated with observed water vapor radiances will be made. Progress - new in-house work unit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0034, SATELLITE INSTRUMENTATION FOR HIGH ENERGY PARTICLES

G.K. Yates, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580070)

AF function - navigation, communication and surveillance. deficiency - inaccurate environmental specification for hardness of microelectronic components will result in insufficient criteria for military satellite systems. Objective - to design, test and calibrate high-energy particle and magnetic-flux detectors for satellite observations. How research contributes - direct measurement of the energetic particle environment in space will lead to a useful model resolving uncertainties in calculations of radiation hardening requirements.

Designs of state-of-the-art instruments for measuring high-energy particles and magnetic flux will be completed. Fabricated instruments acquired under contractual work units supporting this task will be tested and calibrated in preparation for satellite integration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0035, ATMOSPHERIC RESPONSE TO LATITUDINAL VARIATION OF TURBULENCE

S.P. Zimmerman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582860)

AF function - communications, satellite surveillance and satellite orbit prediction. Deficiency - inadequate knowledge of the upper atmosphere, particularly its response to natural and man-made disturbances. Objective - to measure turbulent transfer coefficients in the atmosphere and to develop improved theoretical neutralionic model atmospheres. How research contributes - following solar proton events and nuclear detonations, radio communications are interrupted and missiles and satellites are lost from radar view. Improved models that can predict ionospheric perturbation effects can aid in the improvement of communications and tracking of vehicles. Improved models of the neutral atmosphere will result in more accurate predictions of system satellite ephemerides.

The latitudinal variation of measured turbulence, in conjunction with atmospheric pressure gradients and gravitational forces, controls the behavior of the mean mass motion in the thermosphere. This in turn affects the in situ variations of the neutral constituents as well as the ionic species which are also controlled by the Earth's magnetic field. To examine the atmospheric response to these stimuli and to other perturbations such as ion turbulence, a three-dimensional model of the structure and dynamics of the mesosphere and thermosphere will be developed. Concurrent with this effort, an existing one-dimensional neutralionic atmospheric model will be used to examine thermospheric effects of turbulence over northern latitudes and over the equator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, TROPOPAUSE CLIMATOLOGY

Unknown, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF583570; F19628-79-C-0098)

AF function - environmental impact assessments and laser propagation. Deficiency - current meteorological definition of tropopause height is frequently misleading regarding mid-latitude division between stratosphere air mass and troposhere air mass. This leads to a poor assessment of the stratosphere-troposphere interchange and the rate of removal of stratospheric pollutants. Objective - it is the objective of effort to review existing historical records and derive a more appropriate definition of the tropopause and to then determine the seasonal and latitudinal variations of the mass exchange across the tropopause. How research contributes - the planned measurements will lead to a new description of aerosol distribution in the lower atmosphere. This data will be used in environmental assessments and in computer models predicting optical propagation.

Analyze on a global basis a minimum of ten years of ozonesonde and radiosonde records to evaluate possible definitions of tropopause from the viewpoint of stratosphere-troposphere mass exchange. Apply the appropriate definition to the ten-year set of data to determine suitable climatology. Tables and charts are to be prepared presenting monthly means and frequency distributions as a function of year, latitude and longitude. Estimates of the stratosphere-troposphere exchange are to be determined from seasonal adjustments in the turbopause altitude.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, COASTAL STORMS

P. Feteris, Jackson State University, School of Liberal Arts, Dept. of General Science, *1365 Lynch St., Jackson, Mississippi* 39217 (DN075611; N00014-80-C-0461)

The objective of this research is to study the intensification of convective activity that starts over land and is displaced to sea by cold air outbreaks with subsequent effects on sea condi-

tions and visibility which effects are of concern to naval operations.

Various kinds of satellite data and historical weather map data for the period 1973-80 will be used to accumulate a set of case histories for the study. The sea areas selected for the study are the Persian Gulf, the Red Sea and Arabian Sea which become the destinations of the convective activity that frequently starts over Iran and adjacent land areas and is displaced to sea by cold air outbreaks from the Eurasian land mass. Rough sea and poor visibility due to dust-laden air follow these outbreaks.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0038, MANAGEMENT AND USE OF PRECIPITATION AND SOLAR ENERGY FOR CROP PRODUCTION IN THE NORTHERN GREAT PLAIN

J.K. Aase, U.S. Dept. of Agriculture, Agricultural Research, Northern Plains Soil & Water Center, *P.O. Box 1109, Sidney, Montana* 59270 (0018342; 5710-20760-001)

OBJECTIVE: Develop methods and systems of increasing water-use efficiency by manipulating the microclimate through management techniques to reduce evaporation and increase energy fixation.

APPROACH: The microclimate and associated crop growth parameters will be measured to better understand the basic relationships involved in the soil-plant-air continuum and also to determine which treatment variables favorably affect water-use efficiency and energy fixation under dryland culture. Treatment variables will include those management inputs which decrease wind influence and increase or decrease net radiation, heat flow, and soil and canopy temperatures according to seasonal requirements. Measurements such as canopy temperature and albedo which are compatible with sensing by satellite will be made for correlative and predictive purposes. Lysimetry will be used to study latent energy flux and as a control for evaluating the accuracy of predictive methods for determining evapotranspiration.

PROGRESS: Seven rates--from 0 to 100%-- of 'Olaf' spring wheat and of 'Roughrider' winter wheat, were seeded to stand (100% = 67 kg/ha). A handheld radiometer was used to measure spectral band reflectances, corresponding to the LANDSAT MSS bands. Grain and straw yield data were collected from a number of sources to establish a general relationship between grain and total dry matter (TDM) yields for spring, and TDM for winter wheat. Relationships between the normalized difference vegetation index (ND7 = (MSS7 - MSS5)/(MSS7 - MSS5)) as determined any time between tillering and watery ripe growth stages, and grain and TDM yields established the predictive potential of remote sensing for grain and TDM yields, accounting for 80 to 98% of grain and TDM yields for spring wheat. For winter wheat the relationship, between ND7 and end-of-season TDM, held when determined any time between late tillering to beginning of flowering stages, accounting for 81 to 95% of the TDM production. Because of a strong relationship between grain and TDM yields from a wide variety of cultivars and conditions (r 2 = 0.94) for spring, and r 2 = 0.86 for winter wheat) a universality may exist in this approach towards predicting wheat grain and TDM yields. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research, Idaho - Montana - Utah Area

5.0039, PILOT TESTING OF INTEGRATED WEED CONTROL, SEEDING, AND GRAZING MANAGEMENT ON SAGEBRUSH-GRASSLANDS

R.A. Evans, U.S. Dept. of Agriculture, Agricultural Research, *P.O. Box 8858, Reno, Nevada* 89507 (0043443; 5517-20280-002)

OBJECTIVE: Evaluate rangeland weed control and seeding technologies on an operational scale and integrate these with different grazing management systems. Determine responses in terms of primary effects on livestock production and secondary effects on conservation of wildlife, watersheds and surveyed archeological sites on public domain under jurisdiction of the Bureau of Land Management, USDI.

APPROACH: Apply weed control and seeding treatments for improvement of relatively large areas of representative plant communities. Compare different grazing management systems (fall vs. spring calving) on improved and unimproved range. Study responses of plant communities to improvement and management in terms of cover, density, frequency,and yield. Utilize remote sensing in vegetative analysis. Evaluate effects of these manipulations on livestock performance, wildlife habitat, and watershed values.

PROGRESS: At the Gund Research and Demonstration Ranch twelve treatments for the rehabilitation of degraded sagebrush ranges have been completed or initiated. These 40-acre treatments include: (a) season long grazing under current grazing management; (b) rest-rotation grazing management without range improvement treatments; (c) spraying sagebrush with 3 lb/ac of a LVE of 2,4-D and seeding 'Nordan' crested wheatgrass into the standing, dead brush; (d) rangeland plowing followed by seeding 'Nordan' crested wheatgrass; (e) rangeland plowing followed by seeding a mixture of 'Nordan' crested wheatgrass, alfalfa and fourwing saltbush; (f) spraying brush with 2,4-D followed by application of 1 lb/ac of atrazine for herbaceous weed control, to be followed by seeding crested wheatgrass; (g) application of atrazine to be followed by brush control with 2,4-D and seeding; (h) complete exclusion of domestic livestock; (i) prescribed burning followed by season-long grazing; (j) prescribed burning followed by rest-rotation grazing management; (k) prescribed burning followed by exclusion of grazing by domestic livestock; and (l) prescribed burning followed by seeding of 'Nordan' crested wheatgrass. The prescribed burn was postponed to allow more fuel to accumulate. Each treatment has been enclosed with an experimental high tension, high voltage electric fence.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research, Arizona - New Mexico Area

5.0040, TSUNAMI NETWORK SUPPORT

H.E. Clark, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Albuquerque Seismological Laboratory, *P.O. Box 26659, Albuquerque, New Mexico* 87125 (9920-01263)

STATES TO WHICH PROJECT PERTAINS: New Mexico, California and Alaska.

The objectives to be sought in the current fiscal year are to operate TT-2/TT-3 Tide Systems and the TS-4 Seismic Systems over the GOES SMS satellite network. The TT-2 Tide Systems will be operationally evaluated in an actual NWS facility located in La Jolla, California. The Tsunami Seismic Systems will be operationally evaluated in a realistic system configuration at the Albuquerque Seismological Laboratory, Albuquerque, New Mexico. Various parameters in the event detection and validation unit will be tested for optimum event detection for various types of earthquakes as to size and distance from the TS-4 Seismic System. Each microprocessor type TT-2/TT-3 Tide and TS-4 Seismic System will be operated over the GOES SMS Satellite Network. Five new TT-3 Tide Systems will be developed and four of these TT-3 Tide Systems will be a spare system for the South American Network.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0041, DESIGN AND FABRICATION OF AN AIRBORNE HELIOSTAT ENVIRONMENTAL CHAMBER AND VACUUM CHAMBER

W. Hickox, Aeroflex Lab. Inc., *35 S. Service Rd., Plainview, New York* 11803 (DF260720; F19628-68-C-0254)

AF function - target detection, early warning, acquisition, terminal guidance. Deficiency - IR absorption and emission by the atmosphere interferes with the operation of sensors on early warning and surveillance systems. Research - construct instrumentation for direct measurement of far IR transmission and emission of the upper atmosphere from a KC-135. How research contributes - measurements made with this instrumentation will permit establishment of design criteria for IR sensors used in surveillance and early warning systems operating against atmospheric backgrounds. Abstract - a heliostat and chamber are to be built for installation in a KC-135 aircraft. The chamber covers the heliostat and attaches to the aircraft skin, permitting removal of a window without compromising the pressure integrity of the aircraft. Thus we can bring solar infrared radiation

into the optical system to measure atmospheric transmission without the interfering effects of a window. The heliostat is designed to keep a stationary beam of solar radiation on the optical system when the sun is at 90 degrees to the flight path, with compensation for the normal rolls of the aircraft.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Optical Physics Div.

5.0042, RADIOACTIVITY IN STRATOSPHERIC AIR

E.P. Hardy, U.S. Dept. of Energy, Office of Health & Environmental Research, Environmental Measurements Lab., *376 Hudson St., New York, New York* 10014 (106661 TICNO; 000530)

The objectives of this program are: To document the concentrations of radioactivity in the stratosphere as a function of latitude, altitude, and season; to compute stratospheric burdens of critical tracers; to develop and test stratospheric transport models; and to provide basic data for other scientific programs in studying the ultimate deposition of these tracers in the environment. Two separate projects are involved: the High Altitude Balloon Sampling Program and Project Airstream involving aircraft sampling. The balloon program provides samples from 20 to 27 km at 65, 33, and 9 degrees N several times a year. The aircraft sampling extends from 75 degrees N to the equator in the western hemisphere and ranges in altitude from 12 to 19 km. At least three aircraft missions are flown per year. The filters are analyzed for long-lived fission products, plutonium isotopes, and radon daughter products. Weapons-related radionuclide data are used to update the surface deposition model and assess the radiation-dose contribution to man.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0043, SYNOPTIC AND NUMERICAL STUDIES OF MID-TROPOSPHERIC CYCLONES

F.H. Carr, University of Oklahoma, Norman Campus, School of Arts & Sciences, Dept. of Meteorology, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (ATM79-23918)

The objective of this research is to study Arabian Sea weather disturbances associated with the Indian monsoon. The data for this study were collected by the PI and other scientists from U.S. research aircraft observational platforms during the Global Atmospheric Research Program (GARP) Monsoon Experiment (MONEX) in June 1979. The goal is to obtain a better understanding of the formation, structure, dynamics and predictability of the important rain-producing disturbances that often exist near the west coast of India during the summer monsoon. These disturbances are known as mid-tropospheric cyclones. Both diagnostic and prognostic numerical (computer) models will be used.

MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmosphere and ocean in monsoon regions. MONEX is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the Government of India with the USSR and USA playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to, the U.S., India and the USSR.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0044, A LOW-COST LANDSAT DIGITAL TECHNOLOGY TRAINING PACKAGE

J.A. Harrington, University of Oklahoma, Norman Campus, School of Arts & Sciences, Dept. of Geography, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (OKL-79-RES(2); G 5105039)

OBJECTIVE: The primary objective of this research is to develop a low-cost microcomputer-based instruction aid in LANDSAT satellite digital image processing and its geology applications.

APPROACH: The research approach involves three major steps: development, testing, and subsequent refinement. The development phase was used to assemble the microcomputer analysis system and the supporting instructional materials that will be incorporated in the teaching package. The ongoing testing portion of the research is designed to evaluate the course curriculum and exercise packages that were produced in the development section. Modification and refinement of the instruction aid is scheduled for the upcoming months prior to final assembly of the entire package.

PROGRESS: Considerable progress was identified for the first quarterly reporting period because this coincided with the development phase of the research. During the past three months, the primary emphasis has been to classroom test and evaluate the curriculum and exercises that were previously assembled. The efforts of the past three months correspond with activities outlined in the initial research timetable and, as a result, the overall project is on schedule.

SUPPORTED BY U.S. Dept. of the Interior, Office of Surface Mining Reclamation & Enforcement

5.0045, COHERENT RADAR SEA CLUTTER MEASUREMENTS

O. Kessler, U.S. Dept. of Defense, Navy, Naval Air Development Center, Sensors & Avionics Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881655)

An accurate description of sea echoes including coherent characteristics is needed to design and evaluate future l-band radars for use in sea surface surveillance. The technical objective of this work unit is to collect sea echo-phase and amplitude data and to determine the amplitude and the Doppler statistics that will be necessary for the development of radars for V/STOL, LRAAS, and other future platforms.

The data will be taken with instrumented l- and x-band radars installed on a suitable shore site. Long data records from a stable platform are necessary for significant statistics as a function of clutter Doppler. The statistics will be analyzed for characteristics to enable clutter modeling and performance simulation. This approach complements a PE61152N work unit which provides support for coherent sea clutter measurements. Ch provides support for coherent sea clutter measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

5.0046, NEW DEVELOPMENTS FOR EVALUATING REGIONAL WATERSHED MANAGEMENT PRIORITIES (ABBREV)

Morgan, University of Tennessee, Knoxville Campus, Graduate School, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (A-0060-TENN)

Automated biomonitoring applications to remote water quality stations & satellite data retrieval - new developments for evaluating regional watershed management priorities.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0047, NONLINEAR TRANSFER OF KINETIC ENERGY IN THE ATMOSPHERE USING ONE- AND TWO-DIMENSIONAL SPECTRAL REPRESENTATION

D. Djuric, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (DF051280; AFOSR-78-3492)

AF function - the AF Global Weather Center uses a numerical model to forecast global meteorological conditions in support of AF operations. Deficiency - the physics of the atmospheric energetics are obscured by numerical techniques and limitations. Objective - to investigate the nonlinear transfer of kinetic energy for the Northern Hemisphere by two methods and determine if the forecast models are correctly handling this important parameter and if the one- and two-dimensional spectral representations yield comparable results. Contribution - such spectral representations of dynamic models yield great insight into their representation of the physics and may be the future generation forecast model.

To use the spectral representation now available for the entire Northern Hemisphere and investigate the nonlinear transfer of kinetic energy. Both a one- and two-dimensional analyses will be used and a comparison of the two techniques made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0048, NAVY ENVIRONMENT - GEOPHYSICAL DATA ANALYSIS

S.A. Vincent, Phoenix Corp., 1700 Old Meadow Rd., McLean, Virginia 22101 (DN975375; N00014-79-C-0409)

Satellite altimetry and aeromagnetic data will be analyzed for studies of ocean gravity anomalies, ocean tides, and geomagnetic field fluctuations. Application of gravity gradiometry to geophysical research and Navy operations will be identified.

GEOS-3 and SEASAT satellite altimetry data will be analyzed for ocean tidal components in the northeast Pacific. A detailed background review will be conducted on the relevant physical aspects of the various sources of temporal geomagnetic field variations and their quantitative indicators. The state-of-the-art in moving platform gravity gradiometer instruments and measurements will be determined. Known geophysical features of interest will be modeled and the gradient signatures of the features will be studied for their impact on research and operations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of *Naval Research*

5.0049, NATIONAL ENVIRONMENTAL *OVERVIEW PROGRAM*

J.B. Epstein, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9510-01593)

The National Environmental Overview Program summarizes characteristics and geographic distribution of earth materials and nature and extent of geologic processes in the United States. Maps at a scale of the National Atlas (1:7,500,000) will be major products, although larger scale maps have been and will be prepared. The maps and reports will provide a geologic data base useful to the understanding of environmental problems on a national scale and will be useful for generalized decision making on land use, energy and mineral resource development and their environmental impact, and public health. While maps at this scale probably cannot solve specific problems, they will identify the problems and point out critical areas of potential geologic constraints and guide future topical research.

The program includes preparation of the following maps at 1:7,500,000: landslides, surficial materials, volcanic hazards, active faults, surface water availability, karst and its engineering problems, swelling clays, bedrock lithology, nuclear reactor sites and their geologic problems, density of faults, areas of coal strip mines, Quaternary Dating techniques, radioactive waste management sites, engineering geologic map of the United States, impact structures, and carbonate for SO_2 scrubbing. A quaternary map of the United States (1:1,000,000 and 1:2,500,000) and various environmental and engineering geology derivative maps will be prepared. A data file, allowing the retrieval of many items shown on published geologic maps is being prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological *Survey, Geologic Div.*

5.0050, *MINERAL RESOURCES OF THE SURVEY* PASS QUADRANGLE, BROOKS RANGE, ALASKA

D. Grybeck, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9310-01381)

STATE TO WHICH PROJECT PERTAINS: Alaska.

The major goal of the project is to assess the mineral resources of the Survey Pass quadrangle, Brooks Range, Alaska. It is an integrated program that synthesizes geology, geochemistry, geophysics, and remote sensing. All field work was completed in the summer of 1978, and the remaining work is mainly in compilation of data and preparing reports for publication. These will consist of 37 separate publications and a covering Circular that summarizes the project. The publications include a new geologic map of the quadrangle, maps that show the variations in structure and metamorphic grade, a series of geochemical maps, and an interpretation of the area based on satellite imagery.

SUPPORTED BY U.S. Dept. of the Interior, Geological *Survey, Geologic Div.*

5.0051, SATELLITE ALTIMETRY EVALUATION

W.D. Carter, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Program, 12201 *Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (0-7030-24310)

STATE TO WHICH PROJECT PERTAINS: Arizona

The purpose of this research is to test and refine methodology and to evaluate the applications of GEOS-3 and SEASAT-1 radar altimetry over various land surfaces. Land subsidence due to withdrawal of ground water exceeding recharge has been noted in the Phoenix-Casa Grande area of Arizona during the past 10 years. Maximum subsidence has been measured by standard leveling methods to be as much as 12 feet (4 m) and is believed to continue at a rate of 0.1 m per year. Objectives are to define the known subsidence area from existing GEOS and SEASAT data and to extend the study to the north Tucson area where subsidence is also suspected.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

5.0052, NAVY ENVIRONMENT - COASTAL PROCESSES

R. Dolan, University of Virginia, School of Arts & Sciences, Dept. of Environmental Sciences, Garrett Hall, Charlottesville, *Virginia* 22903 *(DN575068; N00014-75-C-0480)*

The objectives of this research are to determine the periodicity of shoreline dynamics and the persistence of coastal attributes. These findings will be related to research concerned with the seasonal subdivisions of coastal storms, storm tracks, and resultant waves.

Detailed high-resolution coastal information is available from ONR and other research projects. The systematized data for a wide variety of coastal parameters will be subject to multivariate statistical analyses which will permit the establishment of model relationships between coastal attributes. The orthogonal grid map, aerial photography, and satellite imagery will provide the bases for displaying the relationships between coastal variables.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0053, NAVY ENVIRONMENT - SPACE-WEATHER COUPLING

J.T. Ely, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98105 (DN775381; N00014-77-C-0392)

The objective of this research is to examine relationships between changes in the magnetospheric state, i.e., magnetospheric 'openings' (merging of the interplanetary magnetic field, IMF, and the geomagnetic field, GMF, and certain atmospheric events including auroral phenomena, the extent of the cirrus cloud shield, geomagnetic storms, changes in the trapped-particle population, changes in north-south asymmetries (NSA) in galactic cosmic rays, and spacecraft charging at high altitude (SCATHA). Better understanding of the SCATHA problem will be the principal Navy benefit of this research.

To study both the SCATHA and the solar terrestrial problems, satellite and ground-based data will be examined in connection with the time record of known events. Surface NM records, GMF disturbance indices, and IMF polarity will be used to determine if an IMF-GMF connection existed on the dates of recorded SCATHA-type events.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0054, DIAGNOSTICS OF THE HEAT SOURCES AND SINKS OF THE ASIATIC MONSOON AND THE THERMALLY-FORCED PLANETARY SCALE RESPONSE

D.R. Johnson, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meteorology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM78-22384)

The objective of this research is to study the summer and winter Asiatic monsoonal circulations and their interaction with the planetary scale atmospheric circulations. The distribution of heat sources and sinks within the region of the Asiatic monsoons, as well as within the planetary scale, will be diagnosed by two methods. The first method will be to model the distribution of latent, sensible and radiative heating components in the monsoon region using conventional meteorological data, results of other investigators, and satellite data. The second method will be to diagnose heating using a specialized model developed by the PI. The heating distribution from the two methods will be compared and studied. These results, together with conventional data, will be used to isolate the thermally forced mass, energy and angular momentum transport by the Asiatic monsoon and to study its interaction with other planetary circulations.

The data to be used for this study were obtained during the observational phases of the Global Weather Experiment (FGGE) and the Monsoon Experiment (MONEX). Both are subprograms of the Global Atmospheric Research Program (GARP) and took place from late 1978 through 1979.

This project adresses major scientific objectives of MONEX: (1) to obtain a clearer understanding of the interactions between the Asian monsoon and the global circulation, and (2) to obtain quantitative knowledge of heat sources and sinks of the Asian monsoon area.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0055, SUMMER MONSOON WINDSETS DERIVED FROM THE GEOSTATIONARY SATELLITE DATA OVER THE INDIAN OCEAN

J.A. Young, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meterology, *Agriculture Hall, Madison, Wisconsin* 53706 (ATM78-21873)

A U.S. Geostationary Meteorological Satellite over the Indian Ocean will give scientists the first opportunity to view the entire atmospheric monsoon circulation system during one complete annual cycle. The objective of this project is to take advantage of this unique opportunity to obtain complete large-scale wind coverage for the summer monsoon at two heights in the atmosphere. This coverage will include the two experimental areas of summer MONEX (Arabian Sea and the Bay of Bengal), as well as the southern equatorial Indian Ocean during both the 'onset' and 'established' periods of evolution of the atmospheric monsoonal circulation. MONEX, for Monsoon Experiment, is a regional subprogram of the Global Atmospheric Research Program (GARP) to be carried out concurrently with the First GARP Global Experiment (FGGE).

This basic satellite cloud-tracking effort will augment the FGGE satellite wind set by providing additional wind vector estimates of two times per day. Each set will be of relatively high resolution in selected, weather significant areas. The data will form an essential part of an eventual comprehensive MONEX wind set as well as augment the FGGE data set. The data will be made available to MONEX researchers in the following forms: (1) basic 'raw' wind set on computer tape, (2) analysis and gridded wind set on computer tape, and (3) a published atlas from (2).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AN EVALUATION OF THE BREATH EFFLUENT ISOPRENE AS A PHYSIOLOGICAL STRESS PARAMETER

J.P. Stroud, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aeromedical Research Lab., *Fort Rucker, Ozark, Alabama* 36362 (DA0G0426)

Develop a physiological stress parameter to biochemically quantify aviator fatigue in a dynamic in-flight environment.

The hydrocarbon breath effluent isoprene will sampled by the hydrocarbon absorbent TENAX-GC. Aviators exhale through a 3 x 1/4 inch tube packed with the absorbent. The tube is then stored cold until analysis is conducted. The hydrocarbons are liberated by flashing the absorbent tubes at 300 degrees C; the isoprene fraction is separated by gas phase chromatography for mass spectral analysis.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, BEHAVIORAL AND PSYCHOPHYSIOLOGICAL ASSESSMENT OF SKILL DEVELOPMENT

E. Lindholm, Arizona State University, School of Liberal Arts, Dept. of Psychology, *Tempe, Arizona* 85281 (DF056150; F49620-79-C-0197)

AF function - this research supports programs in aircraft training. Deficiency - knowledge about skill development is incomplete partly because of inadequate tools to assess the learning process. Until these tools are perfected, precise measures of skill development will be impossible. Objective - this research will perfect behavioral and psychophysiological measures of human performance which will allow the assessment of learning in complex tasks. How research contributes -reliable and valid measurement tools for skill development will benefit research concerned with teaching complex skills to students in flight and technical training programs.

A pattern approach to assessment of performance will be undertaken using the quantification of several variables simultaneously. The four variables which will initially be studied are cortical-evoked potential, electrodermal response, cardiac response, and eye movement. These variables will be studied for sets of complex tasks using a secondary task methodology for assessing information processing load.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0003, ADVANCED CIG DATA BASE DEVELOPMENT AND ANALYSIS

E.G. Monroe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223760)

To enchance the capability of the advanced simulator for pilot training by providing the capability to generate and visually verify the computer image generation (CIG) data base in the offline mode. In addition, analyses of visual data base structures and advanced software algorithms will be performed. This will provide a broader base for behavioral research and facilitate man-machine interaction.

This effort will develop an automated approach to the generation of CIG visual data bases primarily through the development of software facilitating programs and the addition of interactive computer graphics equipment. The software will be used to generate and verify visual data base material in the offline mode through the use of the interactive graphics equipment. The first step is to complete the software to generate the visual data base. The second step is to install the computer graphics equipment and the third step is to complete the software for data base verification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, INVESTIGATION OF PILOT CONTROL CAPABILITY DURING VIBRATION

H.R. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF316510; F33615-73-C-4003)

Vibration and noise effects are insufficiently understood for general design criteria for advanced aircraft. The objective of this research is to provide the aircraft design community with pilot control performance criteria for mechanically-stressed environments in terms that are readily understood and immediately useful.

The contractor will collect pilot performance data in terms of control system figures of merit under noise, Gz, and random vibration. The ensemble of seat, display, control, operator and controlled element with the command input and mechanical disturbances have mathematically determinable relationships. Take measurements of errors, control activity and operator behavioral properties used to develop models which will have applicability, over operationally likely combinations of variables.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0005, STUDIES OF NUTRITIONAL ADEQUACY AND PHYSIOLOGIC EFFECTS OF DIETS

D.H. Calloway, University of California, Berkeley Campus, Agricultural Experiment Station, Dept. of Nutritional Sciences, *Berkeley, California* 94720 (0003826; CA-B#-NTS-2393)

OBJECTIVE: Determine the extent to which variation in source of nutrients influences physiologic functions and maintenance of nutritional status of humans.

APPROACH: Nutrient sources to be studied are foods and food forms designed to meet the specialized needs of individuals in unusual conditions, such as during space flights, or therapeutic regimens. Responses to be measured include but are not limited to gastrointestinal and renal functions, motor and psychomotor skills, acid-base balance, ketone-body production and intestinal gas formation and exchange. Initial studies will evaluate foods designed for present space flights, in terms of a large number of pertinent responses of healthy young men. Later studies will explore fewer areas of response in greater depth.

PROGRESS: In order to determine if nitrate is produced in the human body, balance studies were done on seven healthy young male volunteers in a metabolic unit. The subjects received initially a mixed foods diet and four defined diets for nine days each: an egg formula control diet, California small white beans, lima beans or wheat bran. The three foods were substituted for formula isocalorically and isonitrogenously. Protein intake was 95 mgN/kg body weight and energy 40-42 kcal/kg body weight. Excreta were collected daily. A modified cadmium reduction method was used to measure nitrate in the diet and in the urines collected the last three days of each dietary period. On the mixed foods diet, intake was 75 mg nitrate-nitrogen/day (332 mg nitrate), and the mean daily urinary excretion was 64 mg nitrogen. On the control formula, white bean, lima bean and wheat bran diets, each with a mean intake of about 2 mg nitrate N/day, the mean urinary excretions were 7-9 mg/day. In each case, with the exception of the mixed foods diet, more nitrate was excreted in the urine than was received in the diet. The probable source of the nitrate is production by intestinal microflora. (Supported in part by USPHS No. AM10202 and a cooperative agreement with USDA).

SUPPORTED BY California State Government

6.0006, LOW-COST TRAINING IMPROVEMENT SYSTEMS

D.A. Norman, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN894037)

Size and cost of current aircrew training devices limit availability and consequently hold time allotted per crew member to a minimal level. Wider availability of devices will improve proficiency and increase readiness and safety.

Low-cost techniques emphasizing mini- and micro-computers, computer graphics and simplified conrols will be evaluated for part-task training. Initial context is helicopter procedures trainer and night carrier landing refresher. Later tasks will include weapons delivery.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0007, MECHANISMS OF SPINAL FAILURE

T.B. Belytschko, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Engineering, *633 Clark St., Evanston, Illinois* 60201 (DF323250; F33615-77-C-0526)

This effort will provide an injury prediction capability for the head-spine computer-based model previously developed under AMRL/BBM sponsorship. This capability is necessary to provide design criteria and evaluation techniques for aircraft emergency escape systems and operational procedures. The effort involves the generation of injury criteria from structural analysis of the elements of the spine, and the incorporation of these injury criteria into the total head-spine model. the final product will have applicability to Air Force problems related to emergency escape from aircraft, aircraft crashes and gross impacts to the head and/or torso.

Structural analyses of vertebral elements will be performed using finite element, or equivalent, methodology and failure-level criteria based on these analyses will be established. The modes of failure to be considered will be those observed from military flight operations, and additional ones which may be anticipated from the operational characteristics of future manned military flight systems. The structural analysis will be performed on the elements of both human and chimpanzee spines. The developed local criteria for failure will be incorporated into the total head-spine model in such a manner as to provide probabilities of failure at every local site considered for a total body impact exposure.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0008, IMPROVE TECHNOLOGY USED TO PREDICT AIRBASE/COMMUNITY NOISE

D.E. Bishop, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF324660; F33615-79-C-0501)

The Air Force uses the noisemap community noise exposure prediction procedure in assessing environmental noise impact and planning compatible land use about airbases. Such actions often involve controversy and even litigation. The objective of this effort is to continue making those studies and modifications which are vital to maintain the present technical credibility of the noisemap procedure.

The contractor will - (1) perform analytical studies of available measured noise data to determine the effects of excess sound attenuation on predicted flight noise levels of various types of aircraft, (2) develop the capability for combining airbase noise contours with those such as for sonic boom or bomb blast having variable grid spacings, (3) perform analytical studies to quantitate the changes in typical Air Force noisemap contours due to uncertainties in the psychoacoustic penalty associated with nighttime aircraft operations, and (4) perform analytical studies to assess the relative importance of uncertainties in the present rules for summing for numbers of operations when computing cumulative noise exposure.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0009, DETECTION, RECOGNITION, AND IDENTIFICATION OF TARGETS IN CIG DISPLAYS

M. Lemay, Montclair State College, School of Science & Mathematics, Dept. of Psychology, *Upper Montclair, New Jersey* 07043 (DF054920; AFOSR-79-0103)

AF function - this research supports the Air Force flying training program, particularly simulator design efforts for electro-optical display training. Deficiency - new generation flight simulators are being equipped with computer image generation (CIG) displays designed to simulate electro-optical cockpit displays (infrared and low light level TV). Because CIG systems lack adequate capacity to reproduce all real world cues, it is necessary to know what to simulate to achieve effective training. The amount of display complexity needed to achieve this result is unknown. Objective - this research will attempt to determine the amount of display complexity needed to train three basic tasks using electro-optical displays - detection, recognition and identification of objects on the ground. How research con-

tributes - the results of this research will add information to the knowledge base concerned with CIG simulation of electro-optical displays. It will impact the design of such simulations.

Three experiments will be conducted to estimate the minimum amount of display complexity necessary to perform detection, recognition, and identification of ground targets. Targets will be imbedded in a CIG scene created by scientists at AFHRL/AS, Wright-Patterson AFB, Ohio. The main independent variable will be the complexity of the scene. Targets will include a hangar, storage tank, water tower, house, office building and aircraft on the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, BIOLOGICAL MATERIAL PROPERTIES AND BIODYNAMIC MECHANISMS

I. Kaleps, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320830)

It is of utmost importance in the development of aerospace manned systems to be able to predict the injury potential to the human occupant of such systems during the design phase. Various approximate analytic and computer modeling techniques have been developed for this purpose, however, the proper implementation of these methods requires a detailed knowledge of the structure, dynamic response and injury mechanisms of the human body. It is the purpose of this effort to assimilate such data and reduce it to the proper form for inclusion in various highly sophisticated biodynamic body models. This will allow predictions of human body response to various and complex mechanical force applications and respective assessments of injury potential.

Analytic and computer model descriptions of the function, structure and dynamic behavior of human biodynamic subsystems will be developed. These studies will be paralleled by investigations of spinal material properties and structure as well as ligament, bone and other tissue properties, infrasound interaction with respiratory function and internal forces and ranges of motions of joints. Efforts will be made to integrate the subsystem characteristics into more encompassing models describing segmental or total body response.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0011, BASIC VISUAL PERCEPTUAL PROCESSES FOR DISPLAYS

W.L. Martin, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322970)

To develop basic laboratory data concerning the detection and identification properties of the human visual system for simple (sinusoidal waveforms) and complex (military targets) objects under normal and abnormal operational environments (e.g., vibration and chemical warfare). To determine the threshold and suprathreshold spatio/temporal filtering properties of the human observer in the fovea and parafovea. To investigate the possibility of improving normal and abnormal vision. To evaluate advanced concepts for operator visual interfacing and quantifying information transfer.

Studies will be conducted using facilities already constructed, the Maxwellianview system (MVS), to investigate human contrast sensitivity. the MVS provides precise spectral and luminace control over sinusoidal waveforms for contrast sensitivity studies. Efforts will also include the creation of a visual psychophysics laboratory (VPL). The VPL will, in addition to the MVS, incorporate a high resolution cathode ray tube (HRCRT) display system to generate simple and complex sinusoid waveforms for the measurement of large field, foveal and para-foveal contrast sensitivity and contrast matching in any orientation. The VPL will also contain a custom made variable contrast device (VCD). The VCD will allow the control of contrast of any object on a 35mm slide to determine the contrast at detection and identification for simple and complex objects. The VPL will develop the capability to obtain visual sensory evoked potentials (VEP) to provide objective, non-invasive data about spatial information transfer characteristics in the observer. The MVS, HRCRT, VCD, and VER will also be used to develop methodologies for possible improvements to normal and abnormal vision. The data collected from these devices will be used to create digital spatial filters that will be used to filter complex objects for basic research and validation studies. The conceptual framework for this research is a multichannel model of the human visual system.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0012, VOICE COMMAND SWITCHING

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The increasing complexity of tactical mission scenarios has placed an increasing workload demand upon the aircrew. Conventional hand and foot operated control modalities coupled with visual displays is taxing the aircrew's ability to meet the challenges of these mission demands. This has led to consideration of other means to carry out the control functions. A potential method for accomplishing these functions, heretofore assumed limited to eye/hand combination, is the use of voice actuated switching (voice controller) coupled with synthetic voice feedback (audio display) for verification. Issues related to use of this novel means for control and display will be investigated. These include effects of dynamic stressors likely to be found in tactical operations, such as vibration, acceleration, noise, etc.

Studies will be initiated to examine the reliability of machine recognition of voice commands when used in simulated operational situations. These studies will consider the potential effectiveness of voice control in the presence of environmental stressors which simulate the operational scenarios of air-to-ground weapons delivery. These stressors include noise, vibration, and buffet, acceleration, and performance task loading. The potential utility of synthetic voice display will be investigated. The first of these will consider voice command reliability when commands are given in the presence of background noise emulating that of an A-10 in air-to-ground attack missions.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0013, ACOUSTIC CUES FOR SPEECH INTELLIGIBILITY AND DISCRIMINABILITY

T.J. Moore, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324120)

Successful tactical air operations demand sustained, effective voice communications for mission fulfillment despite enemy disruption and jamming efforts. The objective of this workunit is inhouse research on tactical voice communications intelligibility, talker discriminability and multiple-part communications with specific applications to tactical air operations.

A series of integrated studies in the AMRL/BB voice communications research and evaluations system (VOCRES) will investigate tactical voice communication parameters which include (a) identification of critical acoustic cues in the communication signal, (b) determination of optimum conditions for the reception of competing messages, (c) impact of the ambient noise environment, (d) effect of various types of jammers on the intelligibility of the communication signal.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0014, DEVELOPMENT AND EVALUATION OF CIG TECHNIQUES

W.L. Foley, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF228920)

The objective is to develop, implement, and perform engineering tests of various potential improvements to CIG. This will include evaluation of non-linear terrain generation methods, circular features techniques, new texturing methods, and new CIG concepts based on application of human perceptual charac-

teristics. The effort will include informal but structured engineering evaluations and the development of refinements necessary to resolve problems.

For each of the four study areas listed in the objective, several tasks will be accomplished. First, evaluation tecniques and criteria will be developed. Then the method under study will be implemented on the advanced CIG techniques evaluation (ACTE) system and subjects will be selected based on their CIG expertise and their familiarity with the real world cues being simulated. The ACTE system will be used to generate static and dynamic scenes which will be used in this effort, as well as in another study designed to examine in more detail the impact of the method on human performance. Finally, the scenes will be evaluated by the subjects using the selected criteria. As required, refinements and retest will be acomplished prior to documentation of results. Eric Monroe is co-monitor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0015, VISUAL ELECTRO-DIAGNOSTICS
R.A. Goodson, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321690)

To provide comprehensive electrodiagnostics for night-vision evaluation in USAF aircrew members referred to USAFSAM, to gain insight into the processes of night-vision disorders through the use of electrophysiology, to advance understanding of basic visual mechanisms objectively with the use of electrical technology.

Application of current technology using averaging computers, storage oscilloscopes, RF-shielded rooms, and other equipment will be continued in evaluating visual physiology. Improved stimuli (integrating spheres) and recording devices (electrodes) will be utilized to advance the quality and scope of collected data. Research into underlying visual mechanisms and processes will be pursued. Efforts previously under Workunit 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0016, SIGNIFICANCE OF ARTERIOGRAPHIC MINIMAL ATHEROSCLEROTIC HEART DISEASE IN THE AIRCREWMEMBER
G.S. Uhl, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF326330)

Minimize the number of flyers who must be grounded because of the presence of minimal coronary artery disease that is functionally insignificant, establish techniques to detect disease progression/ regression, evaluate the effect of risk factor modification on the progression of the disease, and establish the significance of given lesions on long-term prognosis for the purpose of establishing retention criteria.

Aircrewmembers identified as having minimal coronary atherosclerotic heart disease (i.e., a degree of obstruction associated with a coronary event rate that is no greater than that observed in an apparently healthy similar aged population not subjected to cardiac catheterization) will be followed longitudinally with serial risk factor assessment, noninvasive tests (e.g., exercise stress testing), and coronary arteriography to establish significance of given lesions and the influence of risk factor modification on disease progression. Newer noninvasive techniques used to assess the functional capacity of the coronary circulation will be correlated with the results of cardiac catheterization in an attempt to reduce the frequency of the latter procedure at no expense to flying safety and mission completion. This is a continuation of a protocol approved by the USAF SGO, initiated and previously documented under Workunit 7755-18-15.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0017, BIOMEDICAL LIMITS FOR MOLECULAR SIEVE OXYGEN SUBSYSTEMS
D.H. Wood, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322250)

The purpose of this workunit is to determine and define the biomedical limits of the molecular sieve oxygen concentrator subsystem. This effort is necessitated in view of the increased inert gas load in the body caused by the concurrent production of argon by the subsystem at levels 5-10 times that normally found in the atmosphere. This workunit is established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

A systematic analytical determination will be made at ground level and at various altitudes in order to define the inert gas loads in the body resulting from the wash-in of oxygen-argon mixtures and the wash-out of nitrogen. Particular attention will be addressed to conditions when the gas requirements (high workloads) placed on the subsystem are high, resulting in decreased 02 concentration and a concomitant increases in nitrogen concentration along with a 5-10 percent argon concentration. The resulting data will be used to define the boundaries of the molecular-sieve subsystem where decompression will not be hazardous to crew members.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0018, A BASIS FOR EVOKED POTENTIAL ASSESSMENT OF CERTAIN VISUAL FUNCTIONS
D. Regan, Dalhousie University, *Sir Charles Tupper Med. Bldg., Halifax, Nova Scotia, Canada* B3H 4H7 (DF058330; AFOSR-80-0161)

AF function - evoked potential recording is a means of objectively assessing specific visual functions that are relevant to flying and to assessing workload as one element of a workload test battery. Deficiency - the evoked potential literature must be assessed critically before tests are finally designed, and a number of specific experiments must be carried out before fully satisfactory evoked potential tests can be defined. Objective - the research will provide a basis for the design of evoked potential tests of stereoscopic vision, simple visual acuity, pattern (form) vision, and eye-brain conduction speed. How research contributes - the proposed work effort will enhance the realization of a multi-channel workload test battery capability useful for aircrew systems design and operation.

Existing hard copy digitally-derived imagery previously developed as a standard data base will be used to collect both interpreter performance and subjectively scaled quality estimates from trained tactical USAF photointerpreters. As the validity of this effort is dependent upon the use of a real-task scenario, the photointerpreters will be provided with the classified interpretation keys and corollary information typically used in their interpretation tasks. Data collection, therefore, will take place in a typical area used by the photointerpreters during their normal duty hours and with representative USAF equipment such as light table, zoom mciroscope, and tube magnifiers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, EIGENVALUE DISTRIBUTION THEORY FOR GENERAL AND NONNEGATIVE MATRICES, STABILITY CRITERIA (ABBREV)
M. Marcus, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Mathematics, *Santa Barbara, California* 93106 (DF046720; AFOSR-79-0127)

AF function - the design of efficient and stable control systems for future aircraft engines, missile motors, aircraft control surfaces. Deficiencies - the stability of nonlinear as well as some

linear control systems are not well understood. Objective - this research will study the stability theory for systems of differential equations that describe any dynamical system. How work contributes - results may be obtained which may aid the designer of control systems for future aerospace vehicles.

Under this block contract the following topics will be investigated - (1) eigenvalue location and the numerical range, (2) the relationship between eigenvalues and entries of a finite matrix - inequalities for eigenvalues of sum and products, (3) eigenvalue theory for matrices with non-negative entries, (4) hyperbolic initial-boundary value problems, (5) exact matrix and combinatorial computations on the ILLIAC-4. In addition, the computerized linear algebra bibliography will be updated and searches requested by AF laboratories will be honored on time-available basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, SOME ALGORITHMIC PROBLEMS IN LINEAR SYSTEMS

A.G. Lindquist, University of Kentucky, College of Arts & Sciences, Dept. of Mathematics, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF050650; AFOSR-78-3519)

AF function - the design of control systems for high performance aircraft. Deficiency - the design of a linear control system is indeed a straightforward task. However, the design of a nonlinear system which has parameter uncertainty in addition to operation over diverse flight regimes is by no means simplistic and no effective means is available to do this task. Objective - the objective of this research program to develop a system of reduced order equations which can be used to construct methods which are invariant under different choices of stochastic realization, while retaining the convenient Kalman-Bucy recursions. How work contributes - success here would reduce the overall design time in control system implementation.

Research will proceed in four areas. First, the reduced order equations will be investigated to determine if the theory of invariant directions applies. The impetus will be to reduce the number of equations further. Second, a spectral factorization method and the reduced order algorithm will be applied to the stochastic realization problem. Third, an investigation will be pursued of whether the canonical transformation in Hamiltonian systems as applied to the matrix Riccati equation can be utilized on the reduced-order algorithm. Finally, the relations between the reduced-order algorithms and stability of time-invariant linear systems will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, A COMPREHENSIVE MATHEMATICAL MODEL OF THE CARDIOVASCULAR SYSTEM UNDER TIME-DEPENDENT ACCELERATION STRESS

X.J. Avula, University of Missouri, Rolla Campus, School of Engineering, Dept. of Engineering Mechanics, *Rolla, Missouri* 65401 (DF057900; AFOSR-80-0128)

AF function - the Air Force operational environment involves exposure to a wide variety of stresses to include unique strain on the cardiovascular system. The design of protective devices to provide acceleration tolerance for the aircrew member during aircraft maneuvers must take into consideration the response of the cardiovascular system to acceleration stress. A thorough understanding of this system and its structure-function relationship in an abnormal force environment is essential to any effort directed to overcome acceleration effects. Deficiency - the risk of actually exposing humans to high-G stresses to gain some knowledge of the cardiovascular system's response is prohibitive. The alternative is to develop a mathematical model and investigate its response to external excitations that are representative of various aircraft maneuvers. Objective - this effort will develop a comprehensive mathematical model of the cardiovascular system in normal and zero-G environments as well as in high and time-dependent accelerations. How research contributes - the proposed model is expected to lead to a greater accuracy than previously obtained in cardiovascular modeling. It will provide definition of cardiovascular responses that address objectives in RO 1.5.1, Evaluation of Human Capability in a Combined Stress Environment.

The model is based upon the full nonlinear equations of viscous hydrodynamics and elasticity, providing a predictive capability for the effects of all types of external mechanical forces, for example, time-dependent acceleration forces and surface forces upon the cardiovascular system. The model will consist of a closed loop hydrodynamic system in which the blood flow is described by the Navier-Stokes equations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, NUMERICAL METHODS FOR COMPUTER SOLUTION OF ENGINEERING PROBLEMS

S.L. Parter, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Computer Science, *Agriculture Hall, Madison, Wisconsin* 53706 (DN823218; N00014-76-C-0341)

Improvements in the design of both ships and aircraft and a better understanding of the Navy environment depend on more accurate and more rapidly obtainable numerical solutions to differential equations used for description, prediction, and control of physical phenomena. Such phenomena include fluid and gas dynamics, certain chemical reactions, and electrodynamic phenomena. The objective of this task is to develop accurate and efficient methods for the computer solution of differential equations which recur continually throughout engineering applications, with particular emphasis on fluid mechanics.

Both analytical results and numerical methods will be derived for two-point boundary value problems (and singular perturbations thereof), nonlinear elliptic equations, free boundary value problems, and functional ordinary differential equations. Such problems often exhibit very delicate, and even pathological, behavior. Thus, an analytic understanding of the problems is often a necessary prelude to the development of successful numerical techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, COHERENT OPTICAL PHENOMENA AND SOLID-STATE SPIN RESONANCE

E.L. Hahn, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DMR77-18310)

Analog effects known in nuclear magnetic resonance such as rotary saturation and coherent emission damping will be investigated in the optical domain where additional properties of propagation and fluorescence serve to monitor dynamical atomic transition processes. Nuclear magnetic resonance multilevel double- and triple-photon resonance experiments serve to enlarge the understanding of similar optical resonance experiments. A recently achieved new method for coherent phonon generation in single crystals by conversion of electron magnetic spin to phonon energy is to be extended by further refinement of pulsed electron spin resonance techniques. Nonlinear effects of self-induced transparency and picosecond pulse excitation are to be investigated with precision-controlled dye laser sources.

This is a continuation of the research previously supported under DWR7302658A02. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, SCALING BEHAVIOR NEAR VALENCE INSTABILITIES

J.M. Lawrence, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DRM79-06578)

Thermodynamic experiments such as susceptibility, electrical resistivity, and thermal expansion will be carried out to examine the scaling behavior of the effective moment in certain

mixed-valence materials. A cerium-tin-indium alloy, a periodic mixed-valence system, has given indications that some features of single impurity scaling theory are valid. Experiments in other cerium intermetallics will be carried out to test the general validity of the scaling results. These experiments will be done on systems in which the valence can be altered smoothly by alloying, from trivalence to intermediate valence to tetrovalence.

This research was previously supported under DMR 7682109.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, THEORETICAL INVESTIGATIONS OF SURFACE EFFECTS IN SOLIDS AND THE PROPERTIES OF SEMICONDUCTORS

A.A. Maradudin, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DMR78-09430)

The purpose of this research program is to increase our understanding of surface physics and semiconductor physics. The study of surface physics will emphasize lattice dynamical properties. The results should be useful in understanding the phenomena of attenuation, second harmonic generation, and refraction of surface elastic waves. A first-principle quantum mechanical calculation will be made of the atomic force constants at a metal surface which should be useful in interpreting experiments on low-energy electron diffraction. Studies will also be made of the effect of spatial dispersion on surface plasmons which should be of interest in connection with electron energy-loss experiments. The investigations of semiconductor physics will include studies of impurity states and electronic Raman scattering in inversion of metal-oxide-semiconductor devices. The results should improve our understanding of these devices. Impurity states will also be studied in compensated semiconductors in magnetic fields. Excitations known as interface polaritons will be investigated for planar interfaces between two semiconductors differing in such properties as carrier concentration and polar character.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0004, COMMUNICATIONS - SOLIDS AND SOLID SURFACES

W. Kohn, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DN123023; N00014-76-C-0050)

The Navy needs improved understanding of catalysts, corrosion, and energy conversion. Theoretical work under this contract will provide this knowledge of metallic surfaces.

Professor Kohn and his coworkers are doing theoretical calculations of surfaces, interfaces, and electron or hole densities.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, EXPERIMENTAL STUDIES OF CRITICAL SYSTEMS

D.S. Cannell, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR79-10030)

Accurate light-scattering measurements of the static and dynamic properties of a model critical fluid, xenon, at temperatures very near its critical point, will be performed in order to observe slight corrections to asymptotic scaling. Sound velocity studies on the same model system, together with the correlation-range data obtained from the first experiments, will be used to compare sound speed and attenuation with theory. A light-scattering study of spinodal decomposition will also be performed in a binary fluid mixture chosen to minimize multiple scattering; very rapid quenches will be achieved by using pressure changes. Finally, studies of the kinetics of carbon monoxide adsorption on nickel films will be completed and extended to other substrates, and epitaxial films for such studies will be grown.

Research previously supported under DMR 7618962 A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, MATERIALS SUPPORT TECHNOLOGY - CONDUCTING POLYMERS

N.P. Ong, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DN775569; N00014-77-C-0473)

New compositions are needed by the Navy which are lightweight and electrically conducting for advanced sensors and detectors. The objective of this research is to provide new polymeric materials with unique combinations of properties including high electrical conductivity.

The transport properties of niobium triselenide (NbSe3) will be studied. Magnetoresistance studies as well as microwave loss and cyclotron resonance measurements up to 35 GHz will be undertaken. Reflectivity measurements in the far-infrared and NMR studies will be attempted. The non-ohmic behavior of two-dimensional transition-metal di-chalcogenides will be investigated in detail. The current-voltages curves of tantalum disulphide will be measured. Synthesis of new transition-metal chalcogenides with high-conductivity anisotropy will be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0007, PHYSICS OF THE NEAR-SPACE ENVIRONMENT

R.R. Meier, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN320170)

To understand and describe the space environment near earth and how it is affected by the passage of missiles and disruptive effects which may arise from artificial and natural causes. To develop techniques of observing or following such behavior through theoretical analysis. To apply the knowledge gained for the use of new/existing military systems in the areas of early warning attack assessment, midcourse maneuvers, reentry and defense intelligence.

To achieve the above, we envision (a) development of theoretical models of missile signatures which describe their observability above the natural background in UV, (b) analysis of STP 72-1, SOLRAD-HI and OSO-8 and satellite data to learn the natural UV background, and (c) refinement of radiation models of the space environment.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0008, PHYSICAL PROPERTIES - METAL PHYSICS

R.W. Siegel, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (005304 TICNO; 58301)

This Field Task Proposal describes a fundamental research program concerned with the nature and physical properties of atomic defects and their interactions in solids, the atomic mechanisms of diffusion in solids, and the nature and properties of metal-hydrogen systems. The research involves: (1) investigations of atomic and defect diffusivities; (2) equilibrium defect concentrations; (3) interactions of atomic defects with one another, with solute atoms, and with dislocations, interfaces, and surfaces; (4) hydrogen solubility limits; and (5) other properties of metal-hydrogen systems. The work is being carried out in metals (including BCC refractory metals), alloys, hydrides, and glasses, using such experimental techniques as positron-annihilation spectroscopy (PAS), radiotracer diffusion, resistometry, transmission-electron microscopy (REM), field-ion microscopy (FIM), and neutron and x-ray diffraction, along with a complementary theroetical program.

BIBLIOGRAPHIC REFERENCES: Berger, A.S., S.T. Ockers and R.W. Siegel, Measurement of the Monovacancy Formation Enthalpy in Copper, J. Phys. F, Metal Phys. 9(6):

1023-1033 (Jun 1979). Berger, A.S., and R.W. Siegel, Vacancy-Scandium Interaction in Quenched Copper, J. Phys. F, Metal Phys. 9(4): L67-L71 (Apr 1979).

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0009, SHALLOW DONOR IMPURITIES IN HIGH PURITY SEMICONDUCTORS

G.E. Stillman, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DN880264; N00173-79-C-0184)

Microwave and millimeter wave devices and systems are needed for Navy and DOD applications. The active semiconductor materials used or contemplated being used in many of these devices include the III-V semiconductors, gallium arsenide and indium phosphide. In order to fully understand these materials the amount and type of native impurities must be determined.

The total donor and acceptor levels in gallium arsenide shall be determined by conventional means such as Hall measurements and photoluminescence. High resolution for infrared Fourier transform spectroscopy will be used for determination of shallow donor spectra. Comparison of various crystal growth and epitaxial techniques will be made to determine residual donor levels and their dependence on processing techniques and parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, LIGHT SCATTERING STUDIES IN SEMICONDUCTORS AND DISORDERED SOLIDS

M.V. Klein, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR79-02780)

The first objective of this program is to determine how elongated impurities in a crystal change their orientation when there are enough of them to interact strongly with one another. Methods to be used include ultrasonic attenuation and velocity measurements, and inelastic scattering of light, by the sound waves and also by the reorienting impurities themselves. Of interest is whether this system behaves like a real glass and like other random, interacting anisotropic systems known as spin glasses. A second objective is to study electron and hole recombination at impurities in alloys of 3-5 compounds, and to compare the behavior of random alloys and alloys of ordered composition prepared by molecular beam epitaxy (MBE). The technique to be used is resonant excitation of bound exciton luminescence of donors and nitrogen centers in gallium arsenide-gallium phosphide alloys and gallium arsenide-aluminum arsenide alloys, and in ordered superlattice structures of gallium arsenide-aluminum arsenide. These measurements will probe the nature of electrons, holes, lattice vibrations, and their mutual interactions in semiconductors with random and ordered compositional variations. A third objective is to study nearly planar random arrays of donors or acceptors buried in a semiconductor. This will be done by Raman scattering and optical studies of materials such as gallium arsenide doped with germanium grown by MBE. Results will be important for an understanding of metal-insulator transitions and plasma oscillations in nearly two dimensions. This is the first year of a three-year continuing grant.

This research previously supported under DMR 7704382 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, QUANTUM LIQUIDS

C.J. Pethick, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR78-21068)

Research previously supported by DMR7624011. Theoretical research on quantum solids and liquids will be carried out. Particular problems to be studied will include the elementary excitation spectrum of liquid helium (helium-3, helium-4 and dilute mixtures of helium-3 in helium-4), the transport properties of both normal and superfluid helium-3 and relaxation processes in superconductors. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, APPLICATION OF SOFT MODE ANALYSIS TO THE LATTICE DYNAMICS OF DNA AND RNA HELICES

E.W. Prohofsky, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR78-20602)

Research previously supported by DMR7414367.

This project is a theoretical study of the dynamics involving mass displacement of the DNA and RNA helices. In particular those atomic motions which involve change in shape of helixes will be studied. Such changes in shape are brought about by changes in environment or by interaction with biological molecules. It is believed that these changes in shape are involved in the biological functioning of these macromolecules. The method used is that of soft-mode analysis originally used to study displacive phase change in crystalline solids. The method involves calculating the onset of instabilities in the vibrational behavior of a system which leads to changes in shape. A necessary part of this project is the development of accurate models of the vibrational behavior of the helices. Methods will be developed and used on the refinement of the vibrations from observations of the infrared absorption and Raman scattering DNA and RNA. The effect of counter-ions and water of hydration on the vibrations as well as on the shape is to be investigated. The previous successful theory for the B to A DNA change is to be improved and extended to other DNA systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, BAND THEORY OF FERROMAGNETIC METALS

J. Callaway, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (DMR78-17806)

Research previously supported by DMR7619850. Theoretical research on the electronic structure of itinerant ferromagnets will be carried out. In particular, the recently developed methods of energy band theory will be applied to understand various magnetic and transport properties of metals such as nickel and cobalt. Of primary interest will be the calculation of the spin wave excitation spectrum and the dynamic magnetic susceptibility in these materials. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0014, GEOMAGNETIC PULSATIONS - PRODUCTION/INTERPRETATION

M.P. Hagan, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF050140; AFOSR-77-3467)

AF function - disturbances in near-Earth space, such as geomagnetic storms, can degrade the performance of Air Force communication systems. Geomagnetic pulsations are believed to be a promising diagnostic tool for specifying and forecasting such disturbances. Deficiency - an explanation of geomagnetic micropulsations is required that incorporates the observed features of the experimental data. Objective - to establish a detailed phenomenology of geomagnetic pulsations both in the auroral-oval and mid-latitude regimes. Contribution - a thorough analysis of the properties of geomagnetic pulsations is necessary to generate and validate theories of hydromagnetic wave propagation, which can be used to predict and specify geomagnetic disturbances.

This research will strive to provide the necessary additional observational evidence for the geometric progression of magnetospheric resonant frequencies observed in previous analyses. A second data sample which is 24 hours in length and with the polarization in three planes will be analyzed by the polarization trace technique. A study of the pulsations recorded at the Wisconsin AFGL Magnetometer Station will be made with the preselection of filter passbands. Data from a station at lower latitude also will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0015, STATE TO STATE DIFFERENTIAL CROSS-SECTIONS

D.E. Pritchard, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE79-02967)

The research is in the area of quantum chemistry. It deals with the way in which molecules in one particular state react with others. Dr. Pritchard has recently demonstrated a novel technique for measuring angular distributions using the Doppler shift. He plans to apply this technique to the study of energy transfer and chemical reactions in collisions of state-selected diatomic molecules with atoms and with other diatoms. He will study the influence of initial vibration-rotation state and kinetic energy on the differential cross-section for the various product states. It is expected that this advance in specificity will reveal systematic relationships among these variables and that it will also provide highly refined data for comparison with various types of theoretical predictions. This research represents a continuation of that currently supported by Foundation grant CHE7681750.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0016, TUNNELING IN MAGNETIC SUPERCONDUCTING SYSTEMS

A.M. Goldman, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DN875609; N00014-78-C-0619)

This study of the superconducting and magnetic properties of thin-film rare-earth chevral phase materials is of interest to the Navy for possible use in high-power microwave weapons systems exploiting superconductors.

Thin films of rare-earth chevral phase superconductors (e.g., HOMOS, TBMOS and ERMOSE) will be prepared by RF sputtering. Diagnostic techniques used to characterize these films will include X-ray diffraction, transmission electron microscopy and Auger electron spectroscopy. The interplay between magnetic ordering and superconductivity will be studied using both quasi-particle and air-tunneling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0017, LASER AND OPTICAL PHYSICS (13410-P)

M. Lax, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DA0U5578; DAAG29 76 G0055)

To study (1) linear and nonlinear interaction of electromagnetic radiation with electric and magnetic polarization carrying excitations in condensed matter, (2) fluctuations in lasers and condensed matter including hydrodynamic instabilities, and (3) laser physics, including laser resonators, mode competition, light amplification. The use of interdependences between pyro, piezo, magneto, and electroptic properties of materials forms the basis for a part of electronic device technologies. The laser work is relevant to the design of high-power lasers that are desired to operate in a single longitudinal mode to obtain a powerful, narrowly focused beam. The Bernard instability finds application in cloud formation in meteorology and the Rayleigh-Taylor instability is applicable to lubrication and flow over curved surfaces.

(1) A unifying Lagrangian approach is used, for both dissipative and non-dissipative phenomena, emphasizing rotational and displacement invariance in addition to usual (e.g., crystalline) symmetries. (2) Using efficient methods of calculating correlation functions for Fokker-Planck systems, study the onset of Bernard and Rayleigh-Taylor instabilities and the onset of turbulence in laminar flows induced by thermal gradients and shear forces. (3) Corrections to the paraxial approximation to the Maxwell equations are obtained and used to investigate the effects of refraction, gain saturation and diffraction in laser amplifiers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0018, SPECTROSCOPIC STUDIES OF THE ELECTRONIC STRUCTURE OF METAL-SEMICONDUCTOR AND VACUUM SEMICONDUCTOR INTERFACES

D.E. Eastman, International Business Machines Corp., *P.O. Box 218, Yorktown Heights, New York* 10598 (DF042670; F49620-80-C-0025)

AF function - modern aerospace electronic systems for command, control and state electronic and optical devices. Opportunity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitations processes in selected solids. Objective - the objective of this research is to provide knowledge of the electronic structure, electronic transitions and interactions, and optical properties at semiconductor interfaces that are vital to microwave device operations. How work contributes -this work will provide knowledge and understanding of interface states that will permit the development of more reliable and efficient microwave devices for the above system.

Study the electronic structure and properties of vacuum-semiconductor, metal-semiconductor, absorbate-semiconductor, and vacuum-metal interfaces for III-V semiconductors, selected group IV, II-VI and ternary-alloy semiconductors using a variety of techniques including photoelectric-yield spectroscopy, photoelectric spectroscopy, electron energy-loss spectroscopy, Auger electron spectroscopy, and low-energy electron diffraction. A molecular beam epitaxy system will be used to synthesize novel and controlled surfaces and interfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0019, GENERAL RELATIVITY AND ASTROPHYSICS

P. Havas, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (PHY80-08313)

Research in theoretical gravitational physics initiated under NSF grant PHY77-28356 will be concluded. Among the topics to be investigated are: 1. General Relativistic Dynamics: a) Theories with Gauge Groups; b) Exact Solution of the General Relativistic Two-Body Problem; c) Approximate Equations of Motion. 2. Space-Times with Special Symmetry Properties: a) Rotation in General Relativity: Cylindrical Shell; b) Spherically Symmetric Space-Times and Higher Order Field Equations; c) Space-Times with Separable Geodesic Equations. 3. Relativistic Thermodynamics. 4. Electromagnetic and Gravitational Waves in Curved Space: a) Radiation from Rotation Neutron Stars; b) Electromagnetic Field of Rotating Bodies with Arbitrarily Large Charge; c) Collapse of a Radiation Star.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0020, SOFT X-RAY APPEARANCE POTENTIAL SPECTROSCOPY OF 70 YB.

D.R. Chopra, East Texas State University, School of Science & Technology, Dept. of Physics, *E. Texas Station, Commerce, Texas* 75428 (T-643)

The soft X-ray appearance-potential spectra (SXAPS) of ytterbium (Yb) in Yb2O3 have been obtained in the 160-600 eV range with a nondispersive spectrometer, which measures the total X-ray intensity of the anode surface as a function of energy of the incident electrons. The spectra represent the differential excitation probability of 4d core levels and give detailed infor-

mation regarding the self-convolution of the density of unoccupied conduction band states of ytterbium ions in the surface region. The YbN4,5 spectra exhibits two peaks, 3.1 eV apart superimposed on a broad band. The fact that oxygen K and ytterbium N4,5 peaks undergo corresponding changes in intensity on sputtering and on oxidation suggests the formation of a protective chemisorbed oxide layer even under ultrahigh vacuum conditions. The spectral features have been related to the exchange interaction between the 4f electrons and 4d vacancies in Yb.

SUPPORTED BY Robert A. Welch Foundation

8.0021, ANISOTROPY IN ION COLLISION EXCITATION
D.A. Church, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (PHY78-26616)

An investigation of the production of anisotropically excited states in fast ions and atoms by collisions with gas molecules, and with solid and liquid surfaces, will be initiated. Controlled and analyzed surfaces and ion beams will be used to ascertain the effects of adsorbed gases, surface fields, scattering, and charge exchange on the excitation process. Coherence and coincidence measurements will be used.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, SPIN DEPENDENCE OF ION-ATOM COLLISIONS AND HYPERFINE STRUCTURE OF SIMPLE IONS BY REORIENTATION SPECTROSCOPY OF STORED IONS
H.A. Schuessler, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (PHY79-09099)

This research project studies the details of ion-atom and ion-molecule reactions by suspending a number of ions in a specific orientation in an electromagnetic field for many minutes, and bombarding them with a similarly well-defined beam of atoms or molecules. The results show the effects of isolated quantum-mechanical effects, and can be compared directly with theory. The study of simple systems, such as collisions between noble gas ions, and polarized alkali atoms, is emphasized. Molecular alignment by the dynamics of photodissociation will be studied. The spin-dependent collisions are then used to measure fundamental atomic properties by reorientation spectroscopy. The magnetic moments of the electron, bound in the simplest atom, 4He ion (no hfs) and of the simplest molecule, H2 ion and measured to test basic relativistic and radiative contributions to the atomic structure. Hyperfine structure splittings of H2 ion and of its istopic variants will be investigated to test ab initio molecular theories. Certain aspects of the experiments are relevant to plasma in controlled thermonuclear reactions. The charge transfer reactions are possible mechanisms for lasers in the far ultraviolet region. Reactions involving molecular hydrogen and molecular hydrogen ions are important processes in steller atomospheres.

This research is a continuation of that previously supported under NSF grant PHY76-81827A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0023, IONOSPHERE WAVE-PARTICLE EFFECTS
D. Strickland, Science Applications Inc., *1710 Goodridge Dr., P.O. Box 1303, McLean, Virginia* 22102 (DN080175; N00014-79-C-0197)

To investigate the effects of ionospheric plasma wave-particle interactions on the transport of non-thermal electrons.

Develop plasma physics modules which treat wave-particle interactions and incorporate these modules into NRL's existing numerical code of electron transport and deposition in the ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0024, THE INFLUENCE OF AEROSOLS ON ELECTRIC PARAMETERS IN THE FREE ATMOSPHERE (14048-GS)
D.J. Hofmann, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DA0F8900; DAAG29 77 G0046)

To assess the degree of influence that the natural aerosol in the stratosphere has on electrical parameters such as ion density and conductivity. Relevance: The work directly supports research programs at the Atmospheric Sciences Laboratory and the Ballistic Research Laboratories relating to atmospheric effects upon communications, the high-energy laser and ballistic missile defense systems.

Construct a new and better instrument to reliably measure ion density from a balloon-borne platform to be launched from Laramie Station (41 degrees N). This new instrument, plus a dustsonde, will be used to make simultaneous balloon-borne soundings of small ion density and the aerosol concentration in the stratosphere. The corresponding structure and variation in the two profiles will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, OBSERVATIONAL PROGRAM IN GROUND-BASED INFRARED ASTRONOMY
G. Neugebauer, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-20516)

An infrared astronomy program using the telescopes of the Hale Observatories will be carried out. The program emphasizes the unique capabilities of the 200 inch telescope--high spatial resolution with high signal-to-noise--combined with high-sensitivity photometric equipment developed over the past years. Highest priority will be put on high-spatial resolution studies of galactic nuclei and point sources using the 200 inch; this can determine size structure with an uncertainty of approximately 0.1". An increasing emphasis is being placed on high-spatial resolution, medium-spectral resolution spectroscopy. The telescopes at Las Campanas, Chile, and Mauna Kea, Hawaii, will also be used.

The specific scientific programs which will be emphasized include the continuation of the study of molecular hydrogen with high-spatial resolution. The systematic study of the infrared energy distributions of quasars will be continued along with low-resolution spectroscopy to identify atomic lines which are redshifted into the near infrared in comparison with lines which are redshifted into the visible. Several extragalactic- and galactic-ionized hydrogen (H-II) regions will be studied in addition to the observations of regions of star formation within the Galaxy.

This is a continuation of research begun under NSF grant AST 74-18555 A2.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, SPECTROSCOPIC STUDIES OF EARLY STELLAR EVOLUTION AND OF THE CONSTITUENTS OF DENSE INTERSTELLAR CLOUDS
G.H. Herbig, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy & Astrophysics, *Santa Cruz, California* 95060 (AST7726404A01)

This grant will provide support for a program of spectroscopic investigations of young stars and interstellar material. The work will be aimed at increasing our knowledge of the very early stages of star formation. There will be a series of studies at high, intermediate and low resolution. High resolution studies will include searches for weak interstellar lines of molecules, searches for fine structure in diffuse interstellar absorption

bands, and studies of lithium isotope ratios in stars. There will also be studies of spectroscopic binaries among T-Tauri stars. A survey will be made of stellar associations which are rich in T-Tauri stars. There will also be studies of rotation in solar-type stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, INTERNATIONAL MAGNETOSPHERE STUDY IONOSONDE OPERATIONS

K. Davies, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., Space Environment Lab., *Boulder, Colorado* 80302 (ATM78-17301)

In 1975, the Aeronomy Program of the National Science Foundation funded hardware costs for the development of a prototype modern digital HF radar (ATM75-23574). The Space Environment Research Laboratory (SEL, Boulder, Colorado) of NOAA's Environmental Research Laboratories undertook the development, supplying all labor costs. The HF Radar consists of a 20 kW (peak pulse power) transmitter operating from 100 kHz to 30 MHz, a parallel pair of receivers, a mini-computer for overall system control and data processing, two special-purpose micro-processors (one for timing; the other for fast initial data handling), and peripherals (two 5-Megabyte disks, tape drive, graphics displays, etc.). By leaving all possible system parameters under software, rather than hardware, control and great versatility are achieved. (Considerable interest has been shown in this design, and SEL has agreed to build five more units: two with hardware funded by NSF (one for Utah State University/ Stanford University; the other for SEL), one for the Max-Planck Institute for Aeronomy in Lindau, one for the Army's Atmospheric Research Laboratory at White Sands, N.M., and one for the British Antarctic Survey.)

This grant funds the development of this radar for use by the scientific community, particularly for support of the International Magnetosphere Study program. The scientific problems addressed are primarily high latitude and transport at various ionospheric altitudes.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0004, THE EFFECTS OF TRANSPORT PHENOMENA IN THE SOLAR TRANSITION REGION ON COMPUTED-EUV LINE PROFILES

D.E. Billings, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado 80302 (ATM78-22202)*

Solar spectroscopic line profiles contain a great deal of information about the physical processes occurring in the solar atmosphere. In order to extract this information from the observations, it is necessary to understand how heavy ions (responsible for the line emission) behave in the presence of large temperature and density gradients and various magnetic field configurations. This study will derive velocity distribution functions, for several ions formed in the solar chromosphere-corona transition region, from the Boltzmann-Fokker-Planck equation, in the limit of a collision-dominated gas. This would include the effects of thermal diffusion, various magnetic field configurations, non-Maxwellian electron and proton distribution functions and MHD and plasma instabilities (where appropriate) on the ion distribution in phase space. Given the ion distribution function as a function of height in the solar transition region, it will then be possible to compute theoretical line profiles to compare with observations. In this way, a technique is established for evaluating the validity of existing and future transition region-corona models. The overall aim is to understand the thermal properties of the sun.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0005, FAR INFRARED ASTRONOMY (CO-OP)

D.P. McNutt, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia 20375 (DN920018)*

Measure infrared background radiation from stellar, solar, and terrestrial sources to provide data for optimizing military infrared surveillance and intercept equipment. Develop cryogenically-cooled sensors, detectors, and amplifiers for background-limited source detection against high- and low-background surroundings.

Infrared sky survey at 8-120 microns from rocket-borne photometry. develop very high-resolution techniques for detecting line radiation sources against a continuum background. Observe IR-submillimeter (2 microns - 4mm) astronomical sources from ground-based, aircraft and balloon observatories.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

10.0006, A COOPERATIVE PROGRAM FOR THE OBSERVATION OF INTERACTING BINARY STARS

F.B. Wood, State University System of Florida, University of Florida, College of Liberal Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (INT80-12408)

This award provides supplementary funds to Professor Frank B. Wood, University of Florida, to carry out a cooperative research program with Professor Il-Seong Nha, Yonsei University, Seoul, Korea. These astronomers will study close double star systems that show interaction effects as well as mutual eclipses. Using telescope detection systems in Florida and Korea, the investigators will determine times of light maxima, which occur when one star is eclipsed by the other. Since the entire duration of an eclipse often is significantly longer than the interval during which the star can be observed at any one station, two stations well separated in longitude will provide much longer intervals of continuous observation. The collaboration will also be important to those systems with periods of nearly an integral number of days and even with short period systems where the probability of getting a time of minimum in a given observing season is greatly increased. Other observational features that are to be studied by these combined viewings at different longitudes include selected asteroids and the 'humps' (unexplained light increase) shown by systems known as RS Canum Venaticorum variables.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

10.0007, JEREMIAH HORROCKS AND THE NEW ASTRONOMY

W. Applebaum, Illinois Inst. of Technology, Lewis College of Sciences & Letters, Dept. of Humanities, *3300 S. Federal St.,* Chicago, Illinois 60616 (SOC78-12188)

The research aims at completing the collection of materials for the first full-scale biography of the English astronomer Jeremiah Horrocks (1618-1641). The study would be at the same time an investigation of how Kepler's astronomy of elliptical orbits and of his novel conception that astronomers must make physical inquiries as well as kinematic ones were taken up and developed by his immediate successors.

Interest in Horrocks has continued for over three centuries. The projected study will be the first to make use of his manuscripts in order to see him in the context of his time and to make clear his intellectual development as well as his place in the history of his science.

It is hoped that the investigation will illuminate the relationship between empirical and non-empirical factors in the acceptances of new scientific theories.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Social &
Economic Sciences

10.0008, THEORETICAL RESEARCH IN COSMOLOGY AND RELATIVITY

D.R. Brill, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY79-06940)

A number of problems in general relativity and cosmology will be pursued. These problems include (a) the connection between topology of extremal surfaces and physical properties in *solutions of the Einstein equations, (b) mathematical and physical* properties of constant curvature surfaces in asymptotically flat space-times, (c) the structure of solutions in the neighborhood of a *linearization instability,* and *(d) applications of fiber*bundle techniques.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY77-05299A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

10.0009, OPERATION OF CLARK LAKE RADIO OBSERVATORY

W.C. Erickson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST79-08942)

Support is to cover a program of observations with the University of Maryland Teepee Tee Telescope at the Clark Lake Observatory in southern California and to complete the *expansion of the present system into a multi-frequency radioheliograph.* The radio spectra of quasars, supernova remnants, flare stars, and clusters of galaxies will be observed, along with *compact and variable sources at decameter wavelengths, which* will help to identify the energy generation and radio emission processes. Also planets and other objects of interest will be observed. Studies of the radio emission from the quiet and the active sun are planned, with emphasis on coordination of investigations with the Solar Maximum Mission experiments. This will permit study of the nature and origin of coronal transients in collaboration with the White Light Coronagraph Experiment aboard SMM. Similarly, two-dimensional images of drifting bursts with time resolution of 10 milliseconds will assist in understanding the nature of hard X-ray spike bursts, their quasi-periodicity and the electron acceleration process. Images of type II and type IV sources associated with hard X-rays will be crucial in answering the question of origin of coronal hard X-rays, *and in studying the physical processes involved.*

Prior support was by NSF grant AST077-12282A02.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0010, EXTENDED FIELD SPECKLE IMAGE RECONSTRUCTION OF SOLAR FEATURES

R.W. Noyes, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts 02138 (DF580050; F19628-78-C-0026)*

AF function - communications, surveillance, detection, tracking. Deficiency - inability to obtain high-spatial resolution of solar activity undergraded by atmospheric turbulence. Objective - use the techniques known as speckle interferometry to reconstruct images of solar magnetic fields and activity. How research contributes - we are unable to study solar activity at high-spatial detail. In order to adequately predict solar disturbances, which give rise to environmental effects, it is necessary to observe and understand the small scale configurations of solar magnetic fields.

Speckle interferometry utilizing short exposure solar photographs will be used in conjection with the computer techniques known as the Knox-Thompson algorithm to enhance solar *images. The contractor has already demonstrated these methods* in previous work under this contract. In this phase the contractor will process sets of solar speckle data obtained for particu*larly interesting solar magnetic regions.*

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

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VOLUME 19 NUMBER 12/JUNE 23, 1981

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N81-21008* *National Aeronautics and Space Administration, Washington, D. C.*
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY
Mar. 1981 110 p
(NASA-SP-7037(133)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 354 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in February 1981. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-21009*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FLOW VISUALIZATION STUDY OF SPANWISE BLOWING APPLIED TO THE F-4 FIGHTER AIRCRAFT CONFIGURATION
Dale J. Lorincz Aug. 1980 86 p refs Original contains color illustrations
(Contract NAS4-2616)
(NASA-CR-163096; NOR-80-138) Avail: NTIS HC A05/MF A01 CSCL 01A

Water tunnel studies were performed to define the changes that occur in vortex flow fields above the wing due to spanwise blowing over the inboard and outboard wing panels and over the trailing-edge flaps. Flow visualization photographs were obtained for angles of attack up to 30 deg and sideslip angles up to 10 deg. The sensitivity of the vortex flows to changes in flap deflection angle, nozzle position, and jet momentum coefficient was determined. Deflection of the leading edge flap delayed flow separation and the formation of the wing vortex to higher angles of attack. Spanwise blowing delayed the breakdown of the wing vortex to farther outboard and to higher angles of attack. Spanwise blowing over the trailing edge flap entrained flow downward, producing a lift increase over a wide range of angles of attack. The sweep angle of the windward wing was effectively reduced in sideslip. This decreased the stability of the wing vortex, and it burst farther inboard. Reduced wing sweep required a higher blowing rate to maintain a stable vortex. A vortex could be stabilized on the outboard wing panel when an outboard blowing nozzle was used. Blowing from both an inboard and an outboard nozzle was found to have a favorable interaction. A.R.H.

N81-21010*# De Havilland Aircraft Co. of Canada Ltd., Downsview (Ontario).
STATIC TESTS OF THE J97 POWERED, EXTERNAL AUGMENTER V/STOL WIND TUNNEL MODEL
D. B. Garland Feb. 1978 44 p refs
(Contract NASw-2797)
(NASA-CR-152403; DHC-DND-77-4) Avail: NTIS HC A03/MF A01 CSCL 01A

Results of the static testing (zero forward speed) of the J97-powered, external augmentor, large scale, V/STOL model are discussed. With a ground clearance of 7.5 feet, believed to have put the model essentially out of ground effect, a gross thrust augmentation ratio of 1.60 at nozzle pressure ratio (NPR) = 3.0 was measured for the fuselage augmentor. A similar figure was apparent for the wing augmentor. An overall ratio of model thrust to bare engine thrust of 1.52 was determined at NPR = 3.0. The structural integrity of the model was well demonstrated and duct pressure losses were small. M.G.

N81-21011*# National Aeronautics and Space Administration, Washington, D. C.
THE INFLUENCE OF A HIGH PRESSURE GRADIENT ON UNSTEADY VELOCITY PERTURBATIONS IN THE CASE OF A TURBULENT SUPERSONIC FLOW
J. P. Dussauge and J. F. Debieve Dec. 1980 29 p refs Transl. into ENGLISH of "Influence D'un Fort Gradient de Pression Dur Des Perturbations Instationaires de Vitesse Ces D'un Ecoulement Turbulent Supersonique" paper AAF-NT-79-10 Paris 28 p Presented at the 15th Colloq. d'Aerodynamique Appl., Marseille, 7-9 Nov. 1978, Jul. 1979 Translation announced as N80-18348 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Association Aeronautique et Astronautique de France
(Contract NASw-3199)
(NASA-TM-75236; AAF-NT-79-10) Avail: NTIS HC A03/MF A01 CSCL 01A

The amplification or reduction of unsteady velocity perturbations under the influence of strong flow acceleration or deceleration was studied. Supersonic flows with large velocity, pressure gradients, and the conditions in which the velocity fluctuations depend on the action of the average gradients of pressure and velocity rather than turbulence, are described. Results are analyzed statistically and interpreted as a return to laminar process. It is shown that this return to laminar implies negative values in the turbulence production terms for kinetic energy. A simple geometrical representation of the Reynolds stress production is given. E.A.K.

N81-21012# National Aerospace Lab., Tokyo (Japan).
A DESIGN OF MULTI-ELEMENT AEROFOILS FOR HIGH LIFT
Masashi Shigemi Oct. 1980 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-631) Avail: NTIS HC A02/MF A01

A method developed for multielement airfoils for high lift in an incompressible flow is presented. Most airplanes acquire high lift through flaps or slats. High lift is obtained by combining the velocity distribution with multielement airfoils. Velocity distribution for the upper surface of airfoils consists of two parts: uniform velocity distribution, and Wortmann's velocity distribution. The

velocity distribution around the flap and the slat is determined by the geometry of the main element designed to meet the given velocity conditions. The geometry of the main element is created using the panel method for a two dimensional potential flow. The formula of the panel method is linearized approximately in terms of the coordinates. Three examples of multielement airfoils are presented and it is shown that a modification of the shape of the airfoil does not cause disadvantages to the velocity distribution. E.A.K.

N81-21013# National Aerospace Lab., Tokyo (Japan).
CONSIDERATIONS ON BASIS FOR VORTEX-LATTICE METHOD
Teruo Ichikawa Sep. 1980 12 p refs
(NAL-TR-629T) Avail: NTIS HC A02/MF A01

The vortex lattice method for calculating steady subsonic lift distributions of lifting surfaces is discussed. An ideal lattice arrangement of the vortex lattice method for rectangular wings is obtained by applying Stark's quadrature formula for a Cauchy integral to the integral equation of the lifting surface theory. The relation between the circulation of a lattice vortex and the corresponding local lift is thereby clearly defined, and the spanwise distribution of the induced drag is shown to be accurately calculated. It is suggested that application of lattice arrangements as similar as possible to the ideal arrangement for the rectangular wing produces favorable results for more general planforms. E.A.K.

N81-21014*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
KINEMATICS AND DYNAMICS OF VORTEX RINGS IN A TUBE
James G. Brasseur Aug. 1979 225 p refs Sponsored by NASA
(Grant NSF ENG-74-22615)
(NASA-CR-164179; SU-JIAA-TR-26) Avail: NTIS HC A10/MF A01 CSCL 01A

Kinematic theory and flow visualization experiments were combined to examine the dynamic processes which control the evolution of vortex rings from very low to very high Reynolds numbers, and to assess the effects of the wall as a vortex ring travels up a tube. The kinematic relationships among the size, shape, speed, and strength of vortex rings in a tube were computed from the theory. Relatively simple flow visualization measurements were used to calculate the total circulation of a vortex rings at a given time. Using this method, the strength was computed and plotted as a function of time for experimentally produced vortex rings. Reynolds number relationships are established and quantitative differences among the three Reynolds number groups are discussed. A.R.H.

N81-21015*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
A SEMI-ANALYTIC APPROACH TO THE SELF INDUCED MOTION OF VORTEX SHEETS
Leonard W. Schwartz May 1980 42 p refs
(Contract NCC2-55)
(NASA-CR-164177; SU-JIAA-TR-32) Avail: NTIS HC A03/MF A01 CSCL 01A

The rolling up of the trailing vortex sheet produced by a wing of finite span was calculated as a series expansion in time. For a vorticity distribution corresponding to a wing with cusped tips, the shape of the sheet was found by summing the series using Pade approximants. The sheet remains analytic for some time but ultimately develops an exponential spiral at the tips. The centroid of vorticity was conserved to high accuracy. R.C.T.

N81-21016*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CHARTS FOR DETERMINING POTENTIAL MINIMUM SONIC-BOOM OVERPRESSURES FOR SUPERSONIC CRUISE AIRCRAFT
Christine M. Darden Mar. 1981 49 p refs
(NASA-TP-1820; L-14190) Avail: NTIS HC A03/MF A01 CSCL 01A

Charts which give an estimation of minimum achievable sonic-boom levels for supersonic cruise aircraft are presented. A minimization method based on modified linear theory was analyzed. Results show several combinations of Mach number, altitude, and aircraft length and weight. Overpressure and impulse values are given for two types of sonic boom signatures for each of these conditions: (1) a flat top or minimum overpressure signature which has a pressure plateau behind the initial shock, and (2) a minimum shock signature which allows a pressure rise after the initial shock. Results are given for the effects of nose shape. E.A.K.

N81-21017*# Rockwell International Corp., Columbus, Ohio.
A STUDY OF A VTOL THRUSTING EJECTOR IN LOW SPEED FLIGHT, VOLUME 1
V. R. Stewart Mar. 1981 158 p refs
(Contract NAS2-10494)
(NASA-CR-166137-Vol-1; NR80H-102-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 01A

Low speed aerodynamic characteristics of a thrust augmenter wing suitable for vertical operation were investigated. Wind tunnel test results on the ejector and a similar configuration with a blown flap are analyzed. The configurations represented a VTOL concept at conditions of thrust deflections required for low forward speed flight. The model tested had an unswept untapered wing. Specific data included normal longitudinal forces and moments, surface pressures, ejector exit surveys, and flow field surveys behind the wing. E.A.K.

N81-21018*# Rockwell International Corp., Columbus, Ohio.
A STUDY OF A VTOL THRUSTING EJECTOR IN LOW SPEED FLIGHT, VOLUME 2
V. R. Stewart Mar. 1981 546 p refs
(Contract NAS2-10494)
(NASA-CR-166137-Vol-2; NR80H-102-Vol-2) Avail: NTIS HC A23/MF A01 CSCL 01A

An experimental investigation of V/STOL thrust augmenter wings in flight at slow forward speeds is reported. Two rectangular planforms of differing relative chord lengths were tested. The augmenters were positioned in the aft portion of the wing to produce increases in circulation lift. Two blown flap configurations were tested for comparison. Surface pressures as well as total forces and moments were obtained on the semispan models at two flap deflections and a range of momentum coefficients. Tabulations of surveys at the pressure augmenter exit, downwash surveys downstream of the wing, and force and moment data are included. E.A.K.

N81-21019*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A CORRELATION METHOD TO PREDICT THE SURFACE PRESSURE DISTRIBUTION ON AN INFINITE PLATE FROM WHICH A JET IS ISSUING
Stanley C. Perkins, Jr. and Michael R. Menhall May 1978 121 p refs
(Contract NAS2-9509)
(NASA-CR-152160; NEAR-TR-160) Avail: NTIS HC A06/MF A01 CSCL 01A

A correlation method to predict pressures induced on an infinite plate by a jet issuing from the plate into a subsonic free stream was developed. The complete method consists of an analytical method which models the blockage and entrainment properties of the jet and a correlation which accounts for the effects of separation. The method was developed for jet velocity ratios up to ten and for radial distances up to five diameters from the jet. Correlation curves and data comparisons are presented for jets issuing normally from a flat plate with velocity ratios one to twelve. Also, a list of references which deal with jets in a crossflow is presented. J.M.S.

N81-21020# Texas Univ., Arlington. Dept. of Aerospace Engineering.
SOME NEW HOT WIRE MEASUREMENTS OF THE MEAN AND FLUCTUATING VELOCITIES IN A SUBSONIC FREE JET
Aspi Rustom Wadia, Parviz Kashani, and Fred R. Payne [1981] 10 p refs
Avail: NTIS HC A02/MF A01

Hot wire anemometer measurements of the mean velocity profile and turbulence intensity were made in a free jet of radius

1.954 mm at exit Mach numbers of 0.19 and 0.2558 and Reynolds numbers (based on the jet radius, R) of 94,339 and 127,053. The regions of interest were: (1) the central core of the jet; (2) the mixing region where the turbulence intensity is high; and (3) the fully turbulent region several diameters downstream of the nozzle. The hot wire data obtained were reduced using an off line computer program. Author

N81-21021*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.

AERODYNAMIC PREDICTION TECHNIQUES FOR HYPERSONIC CONFIGURATION DESIGN Final Report

Mar. 1981 93 p refs

(Contract NAS1-15820)

(NASA-CR-165651; NA-80-611) Avail: NTIS HC A05/MF A01 CSCL 01A

An investigation of approximate theoretical techniques for predicting aerodynamic characteristics and surface pressures for relatively slender vehicles at moderate hypersonic speeds was performed. Emphasis was placed on approaches that would be responsive to preliminary configuration design level of effort. Potential theory was examined in detail to meet this objective. Numerical pilot codes were developed for relatively simple three dimensional geometries to evaluate the capability of the approximate equations of motion considered. Results from the computations indicate good agreement with higher order solutions and experimental results for a variety of wing, body, and wing-body shapes for values of the hypersonic similarity parameter M delta approaching one. Author

N81-21022*# National Aeronautics and Space Administration, Washington, D. C.

THE AERODYNAMICS OF SMALL REYNOLDS NUMBERS

F. W. Schmitz Jun. 1980 47 p refs Transl. into ENGLISH from Friedr. Vieweg and Sohn (West Germany), 1954 p 149-166 Presented at the Jahrbuch 1953 der Wiss. Ges. fuer Luftfahrt E. V. mit den Vortraegen der WGL-Tagung in Goettingen, Braunschweig, West Germany, 26-29 May 1953

(Contract NASw-3199)

(NASA-TM-75816) Avail: NTIS HC A03/MF A01 CSCL 01A

Aerodynamic characteristics of wing model gliders and bird wings in particular are discussed. Wind tunnel measurements and aerodynamics of small Reynolds numbers are enumerated. Airfoil behavior in the critical transition from laminar to turbulent boundary layer, which is more important to bird wing models than to large airplanes, was observed. Experimental results are provided, and an artificial bird wing is described. E.A.K.

N81-21023*# National Aeronautics and Space Administration, Washington, D. C.

AN EXPLANATION OF THE INSTABILITY OF THE FREE VORTEX CORES OCCURRING OVER DELTA WINDS WITH RAISED EDGES

H. Ludwieg Sep. 1980 26 p refs Transl. into ENGLISH from Z. fuer Flugwissenschaften (West Germany), vol. 10, no. 6, Jun. 1962 p 242-249 Translation was announced as N63-84062 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Aerodynamic Test Inst., Goettingen

(Contract NASw-3199)

(NASA-TM-75861) Avail: NTIS HC A03/MF A01 CSCL 01A

By rolling up the surfaces of discontinuity originating from the leading edge of delta wings, free vortex cores are formed above the wing. In case of greater angles of incidence, the flow in these vortex cores shows an instability which abruptly produces strong turbulence. In the present paper an explanation is given of this instability being a 'frictionless instability' of the vortex core flow by increasing helical interference vortices. The occurring vortex core flows are calculated and investigated for stability by means of a stability criterion concerning flows with helical streamlines given by H. Ludwieg. Author

N81-21024*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL INVESTIGATION OF THE FLOW ON THE SUCTION SIDE OF A THIN DELTA WING

Dietrich Hummel Mar. 1981 15 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 13, Jul. 1965 p 247-252

(Contract NASw-3198)

(NASA-TM-75897) Avail: NTIS HC A02/MF A01 CSCL 01A

Surface oil flow patterns were photographed and pressure distribution measurements were carried out on a sharp edged delta wing of aspect ratio lambda = 1.0 in order to determine the influence of Reynolds number and of vortex breakdown on the flow on the suction side of the wing. The formation of the secondary vortex occurs due to separation of a laminar boundary layer in the front part of the wing and due to separation of a turbulent boundary layer in the rear part of the wing. In the case of turbulent separation, the secondary separation line is closer to the wing leading edge than in the laminar case. The position of the transition depends on the Reynolds number and on the angle of incidence. The breakdown of a vortex above the wing leads to a kink in the secondary separation line.Author

N81-21025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NUMERICAL SOLUTION OF COMPRESSIBLE VISCOUS FLOWS AT HIGH REYNOLDS NUMBERS

Robert W. MacCormack Mar. 1981 26 p refs

(NASA-TM-81279; A-8524) Avail: NTIS HC A03/MF A01 CSCL 01A

A new numerical method which was used to reduce the computation time required in fluid dynamics to solve the Navier-Stokes equations at flight Reynolds numbers is described. The method is the implicit analogue of the explicit finite different method. It uses this as its first stage, while the second stage removes the restrictive stability condition by recasting the difference equations in an implicit form. The resulting matrix equations to be solved are either upper or lower block bidiagonal equations. The new method makes it possible and practical to calculate many important three dimensional, high Reynolds number flow fields on computers. E.A.K.

N81-21026*# New York Univ., N. Y.

AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE AERODYNAMICS OF A HYPERSONIC VEHICLE AT FREE STREAM MACH 6 Final Report

V. Zakkay, C. R. Wang, H. Parikh, and A. Munakata Apr. 1981 22 p refs

(Grant NsG-1444)

(NASA-CR-164133) Avail: NTIS HC A02/MF A01 CSCL 01A

The goal of this research is the assessment of the validity of existing three dimensional numerical programs in the prediction of the flow fields about general three dimensional hypersonic bodies. A detailed experimental research program was performed in which surface and flow field pressures were mapped. The results of the experimental work were compared with existing inviscid programs. Improvements were made on the existing numerical methods to include angle of attack. A summary of this work is presented. T.M.

N81-21027*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FLUID MECHANICS MECHANISMS IN THE STALL PROCESS OF HELICOPTERS

Warren H. Young, Jr. Mar. 1981 12 p refs Presented at Symp. on Numerical and Phys. Aspects of Aerodyn. Flows, Long Beach, Calif., 19-21 Jan. 1981 Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.

(NASA-TM-81956; USAAVRADCOM-TR-81-B-1) Avail: NTIS HC A02/MF A01 CSCL 01A

Recent experimental results from airfoils in the Mach number, Reynolds number, or reduced frequency ranges typical of helicopter rotor blades have identified the most influential flow mechanisms in the dynamic stall process. The importance of secondary shed vortices, downstream wake action, and the flow in the separated region is generally acknowledged but poorly understood. By means of surface pressure cross-correlations and flow field measurements in static stall, several new hypotheses have been generated. It is proposed that vortex shedding may be caused by acoustic disturbances propagating forward in the lower (pressure) surface boundary layer, that wake closure is a misnomer,

and that the shed vortex leaves a trail of vorticity that forms a turbulent free shear layer. The known dynamic stall flow mechanisms are reviewed and the potential importance of recently proposed and hypothetical flow phenomena with respect to helicopter blade aeroelastic response are assessed. J.D.H.

N81-21028*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOW AND HIGH SPEED PROPELLERS FOR GENERAL AVIATION: PERFORMANCE POTENTIAL AND RECENT WIND TUNNEL TEST RESULTS

Robert J. Jeracki and Glenn A. Mitchell 1981 29 p refs Presented at the Natl. Business Aircraft Meeting, Wichita, Kan., 7-10 Apr. 1981; sponsored by SAE

(NASA-TM-81745; E-799) Avail: NTIS HC A03/MF A01 CSCL 01A

The performance of lower speed, 5 foot diameter model general aviation propellers, was tested in the Lewis wind tunnel. Performance was evaluated for various levels of airfoil technology and activity factor. The difference was associated with inadequate modeling of blade and spinner losses for propellers round shank blade designs. Suggested concepts for improvement are: (1) advanced blade shapes (airfoils and sweep); (2) tip devices (proplets); (3) integrated propeller/nacelles; and (4) composites. Several advanced aerodynamic concepts were evaluated in the Lewis wind tunnel. Results show that high propeller performance can be obtained to at least Mach 0.8. E.A.K.

N81-21029*# Rockwell International Corp., Los Angeles, Calif. North American Aircraft Div.

AERODYNAMIC PRELIMINARY ANALYSIS SYSTEM 2. PART 1: THEORY Final Report

E. Bonner, W. Clever, and K. Dunn Apr. 1981 128 p refs (Contract NAS1-15674)

(NASA-CR-165627; NA-80-374-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 01A

A subsonic/supersonic/hypersonic aerodynamic analysis was developed by integrating the Aerodynamic Preliminary Analysis System (APAS), and the inviscid force calculation modules of the Hypersonic Arbitrary Body Program. APAS analysis was extended for nonlinear vortex forces using a generalization of the Polhamus analogy. The interactive system provides appropriate aerodynamic models for a single input geometry data base and has a run/output format similar to a wind tunnel test program. The user's manual was organized to cover the principle system activities of a typical application, geometric input/editing, aerodynamic evaluation, and post analysis review/display. Sample sessions are included to illustrate the specific task involved and are followed by a comprehensive command/subcommand dictionary used to operate the system. E.A.K.

N81-21030*# Rockwell International Corp., Los Angeles, Calif. North American Aircraft Div.

AERODYNAMIC PRELIMINARY ANALYSIS SYSTEM 2. PART 2: USER'S MANUALS Final Report

P. Divan Apr. 1981 254 p refs (Contract NAS1-15674)

(NASA-CR-165628; NA-80-374-Pt-2) Avail: NTIS HC A12/MF A01 CSCL 01A

An aerodynamic analysis system based on potential theory at subsonic/supersonic speeds and impact type finite element solutions at hypersonic conditions is described. Three dimensional configurations having multiple nonplanar surfaces of arbitrary planform and bodies of noncircular contour may be analyzed. Static, rotary, and control longitudinal and lateral directional chracteristics may be generated. The analysis has been implemented on a time sharing system in conjunction with an input tablet digitizer and an interactive graphics input/output display and editing terminal to maximize its responsiveness to the preliminary analysis problem. Typical simulation indicates that program provides an efficient analysis for systematically performing various aerodynamic configuration tradeoff and evaluation studies. E.A.K.

N81-21031# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

THREE-DIMENSIONAL SUPERSONIC VISCOUS FLOW OVER A CONE AT INCIDENCE

A. Lin and S. G. Rubin Jan. 1981 15 p refs Presented at the 19th AIAA Aerospace Sci. Meeting, St. Louis, Mo., 12 - 15 Jan. 1981

(Contract N00014-79-C-0849)

(AD-A096232) Avail: NTIS HC A02/MF A01 CSCL 20/4

The viscous supersonic flow over a sharp cone at incidence is examined numerically with a coupled strongly implicit algorithm for the properties in the plane normal to the cone axis. The Navier-Stokes equations are considered in a boundary layer-like or parabolized manner and global relaxation is considered for the pressure interaction. It is shown that departure effects can be effectively eliminated by forward differencing for the axial pressure gradient. Moreover, this approximation retains the implicit free pressure interaction required for geometries where axial flow separation is possible. GRA

N81-21032# ARO, Inc., Arnold Air Force Station, Tenn.

ANALYTICAL AND EXPERIMENTAL THERMAL ANALYSIS OF A GUIDED BOMB Final Report, Oct. 1978 - Sep. 1979

W. K. Crain and R. K. Matthews AEDC Feb. 1981 66 p refs

(AD-A095890; AEDC-TR-79-91) Avail: NTIS HC A04/MF A01 CSCL 09/2

As part of a technology program to investigate the transient heating problems associated with high-speed carriage of conventional stores, an analytical and experimental thermal analysis was conducted on a guided bomb. The objective of this work was to investigate the technology necessary to develop an analytic model from which store internal component thermal response could be generated. In addition, a radiant-heat ground test was conducted on instrumented flight hardware for the purpose of generating experimental data for calibrating the analytic model. A new test technique was developed to simulate the predicted flight heating distribution over the store. The results demonstrate an analytical and experimental approach for predicting store internal component thermal response. Comparison of the analytic model and ground test results shows adequate agreement in the bomb section but a general lack of agreement in sections containing electronic components. This lack of agreement is attributed to the uncertainty in component thermal properties, contact resistance, modeling assumptions, and general complexity of the store hardware. The results illustrate the importance in experimental validation of the analytic model. GRA

N81-21033# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A SINGULAR PERTURBATION METHOD FOR ARBITRARY CONFIGURATIONS IN SUBSONIC POTENTIAL FLOW Ph.D. Thesis

Frederick M. Jonas Oct. 1980 110 p refs

(AD-A096057; AFIT/DS/AA/80-3) Avail: NTIS HC A06/MF A01 CSCL 20/4

A method is developed for obtaining uniformly valid solutions about slender bodies (2-D or 3-D) with round leading/trailing edges in compressible subsonic flow. The method is based on the principles of singular perturbation theory and applied to nonlifting thickness problems. The method corrects small perturbation theory (outer solution) with a stagnation region theory (inner solution) yielding uniformly valid solutions. Analytic results of the first and second order method are presented and compared to other methods, including exact numerical results, for the elliptic cylinder. The first order method is shown to be preferred to higher order efforts and is directly applicable to current numerical techniques solving the Prandtl-Glauert equation. Application of the first order method numerically, using a current panel technique, is presented for the NACA 0012 airfoil and a glide bomb configuration. All comparisons of the first order composite results with other methods show excellent agreement and improved results subject to the limits of validity of the theory. The ability to correctly model the flow behavior in stagnation regions using the composite solutions leads to a greater confidence in aerodynamic predictions, especially inviscid drag estimates. GRA

N81-21034# Polytechnic Inst. of New York, Farmingdale. Aerodynamics Labs.

HYPERSONIC AND OTHER VISCOUS INTERACTIONS. APPENDIX A: THREE-DIMENSIONAL VISCOUS INTERACTIONS Final Report, 1 Nov. 1977 - 30 Sep. 1980

Robert J. Cresci and Stanley G. Rubin Dec. 1980 65 p refs

(Contract F49620-78-C-0020; AF Proj. 2307)
(AD-A095817; POLY-M/AE-80-32; AFOSR-81-0155TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A study has been made of transpiration cooling of typical hypersonic re-entry configurations with a primary emphasis on experimental data acquisition, although some limited analytical and numerical support studies have been undertaken. The experiments have been conducted in the hypersonic flow region, under zero and non-zero angle of attack conditions, and covering the range in Reynolds numbers required to obtain laminar, transitional, and turbulent data. Numerical and analytical studies have been performed of viscous and interacting viscous-inviscid flows with application to 3D boundary layers, wing-body configurations, and internal flow problems. In this area, the development of numerical techniques and analytical tools is of primary significance although the application of these methods to practical problems of interest has also been accomplished.
GRA

N81-21035# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.

WIND TUNNEL EVALUATION OF AEROELASTICALLY CONFORMABLE ROTORS *Final Report*

R. H. Blackwell, Jr. and K. C. Frederickson Jan. 1981 113 p refs
(Contract DAAJ02-77-C-0047; DA Proj. 1L2-62209-AH-76)
(AD-A096129; SER-510039; USAAVRADCOM-TR-80-D-32)
Avail: NTIS HC A06/MF A01 CSCL 20/4

The concept of controlling blade dynamic twist to reduce rotor system loads and to improve aerodynamic efficiency was investigated through wind tunnel testing and analysis. Blade design features which promote favorable dynamic twist were selected based on aeroelastic analysis. Two four-bladed 9 ft diameter 1/6 scale model rotors which permitted parametric investigation of blade torsional stiffness, tip sweep, and camber were fabricated and subjected to forward flight testing in the Langley Research Center Transonic Dynamics Wind Tunnel. The azimuthal variation of dynamic twist was determined based on measured twisting moments. Results showed that relative to a conventional stiffness blade, 20 to 40 percent reductions in vibratory flatwise and torsional moments and 10 percent reductions in power were achieved at an advance ratio of 0.3 by configurations which produced noseup elastic twist on the advancing blade. Four/rev hub vibration was also reduced by blades which reduced advancing blade total twist. The important trends shown by the test results were adequately predicted by a blade aeroelastic response analysis although magnitudes of blade loads were generally unpredicted. GRA

N81-21036# United Technologies Research Center, East Hartford, Conn.

AN ANALYSIS OF THE INLET PLANE AERODYNAMICS OF AN OSCILLATING SUBSONIC CASCADE: AN EVALUATION OF EXPERIMENTAL DATA *Final Report, 1 Sep. 1979 - 28 Feb. 1981*

Arthur O. St.Hilaire 27 Feb. 1981 54 p refs
(Contract N00014-79-C-0772)
(AD-A096077; UTRC/R81-914838) Avail: NTIS HC A04/MF A01 CSCL 20/4

An analysis has been performed on unsteady pressure data measured in the leading edge region of a subsonic cascade oscillating in pitch. The objectives of the investigation were to determine the sensitivity of the freestream velocity disturbance at the inlet plane to variations in interblade phase angle, to compare the behavior of the freestream velocity disturbance as a function of interblade phase angle with that of both the inlet area oscillation and the measured moment response of the cascade, and to determine the influence of the gap-to-chord ratio on the blade loading near the leading edge. In this study, it was found that the behavior of the unsteady freestream flow entering an oscillating subsonic cascade is strongly influenced by the interblade phase angle. A more important finding was that the primary trends in the freestream disturbance match those of both the inlet area oscillation and the moment response of the cascade. Because of this correlation, a hypothesis is presented that describes how the interaction between the inlet area oscillation and the freestream flow might be relevant to the behavior of the cascade moment response and thus to the stability of the cascade motion. Analytical predictions based on this hypothesis are in qualitative agreement with the measured trends. The effect of gap-to-chord ratio on the unsteady blade loading was studied and found to be substantial in two ways: it alters the degree of influence of leading edge dynamic stall on the chordwise load distribution, and it alters the degree of influence of the interblade phase angle on the amplitude of the load response. GRA

N81-21037# *Rolls-Royce Ltd., Derby (England).*

THE RB211 ENGINE AND ITS DEVELOPMENT

C. A. Elliott 1980 48 p Original contains color illustrations
(PNR-90043) Avail: NTIS HC A03/MF A01

The design philosophy of this three shaft high bypass ratio engine is presented. Seal design and blade cooling in the high pressure turbine are delineated. Safety practices relating to critical rotating parts are outlined as follows: inspection; nondestructive and destructive testing; and manufacturing controls beginning with the forging billets. Disk failures in two engines are analyzed and performance and fuel consumption data are given.
Author (ESA)

N81-21038# *National Aerospace Lab., Amsterdam (Netherlands).* Scientific Services Div.

INTEGRAL EQUATION METHODS FOR MULTI-ELEMENT AIRFOIL ANALYSIS AND DESIGN

T. E. Labrujere May 1979 50 p refs Presented at Colloq. on Numerical Treatment of Integral Equations, Amsterdam, 27 Apr. 1979
(Contract NIVR-1819)
(NLR-MP-79020-U) Avail: NTIS HC A03/MF A01

A number of alternative approaches for solving the analysis problem are discussed. These approaches have in common a second order representation of both airfoil contour and doublet distribution, but are based on different integral equations. The method based on integral equations and spline representations appears promising for practical applications. An efficient optimization procedures for solving the design problem is described. All matters are illustrated with the aid of numerical results. Author (ESA)

N81-21039# Bristol Univ. (England). Dept. of Aeronautical Engineering.

AN INVESTIGATION INTO THE POSSIBLE REDUCTION OF AERODYNAMIC DRAG OF A FUEL ECONOMY VEHICLE B.S. Thesis

A. J. Underwood and C. Young Jun. 1980 72 p refs
(BU-248) Avail: NTIS HC A04/MF A01

The drag of a low speed fuel economy vehicle was investigated with respect to changes to the body design, and the inclusion of certain add on devices. The characterictics of the unmodified and modified vehicles were determined in wind tunnel experiments. It was demonstrated that a drag coefficient of 0.28 can be obtained, representing a reduction of 55% compared with the unmodified vehicle. The results indicate that even lower drag can be achieved. Wheel and wheel/body interference drag contributed on the order of 1/3 to the total aerodynamic component. Major wheel design modifications and relocation should lead to a reduction in this contribution. Author (ESA)

N81-21040# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Entwurfsaerodynamik.

TENDENCIES IN THE DEVELOPMENT OF SUBSONIC TRANSPORT-AIRCRAFT UNDER SPECIAL CONSIDERATIONS OF AERODYNAMICS

Horst Koerner Jun. 1980 63 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-705)
(DFVLR-Mitt-80-15) Avail: NTIS HC A04/MF A01

Tendencies in subsonic transport aircraft development, specifically due to progress in aerodynamics, are surveyed. Prospective wing profile designs and improved integration of body dimensions are considered, citing examples from the AIRBUS development program. Possible fuel savings through supercritical wing technology and by optimizing reduction in friction drag are also studied. Advantages to be gained by active control, particularly from adaptive wing technology, are then reviewed. As a potential

application, an unconventional canard configuration, including transonic propellers, for an aircraft in the AIRBUS class is proposed. Author (ESA)

N81-21041# European Space Agency, Paris (France).
UNSTEADY PRESSURE MEASUREMENTS DURING STALL AND BUFFETING
Peter Bublitz Jan. 1981 49 p refs Trans. into ENGLISH of "Messung von instationaeren Druecken bei Stall u. Buffeting" Rept. DFVLR-Mitt-79-09, DFVLR, Apr. 1979 Original report in GERMAN previously announced as N80-25300
(ESA-TT-641; DFVLR-Mitt-79-09) Avail: NTIS HC A03/MF A01

The fluid dynamics of stall and buffeting and their effects on elastic structures are described. Using a generalized form of the equations of motion and applying Fourier transformation techniques, the dynamical solution and the quantities that govern it are briefly discussed. The experimental apparatus and the measurement method are described. Results from wind tunnel tests relating to the measurement of stall on a trapezoidal stalled wing with and without strakes are presented. Author (ESA)

N81-21042# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
ON THE ROLE OF LAMINAR SEPARATION BUBBLES IN AIRFOIL LEADING EDGE STALLS
B. vandenBerg 13 Feb. 1980 22 p refs Submitted for publication
(NLR-MP-80010-U) Avail: NTIS HC A02/MF A01

Bursting of the laminar separation bubble near an airfoil leading edge and turbulent boundary layer separation in the leading edge region were studied to determine the relative importance of both mechanisms for leading edge stalls. A theoretical analysis is made of the flow around symmetrical Joukowski airfoils, which suggests that turbulent layer separation in the nose region is the dominant cause of leading edge stalls, especially at higher Reynolds numbers. An analysis of measured wall shear stress data in the nose region of two modern airfoil sections, NLR airfoils 7303 and 7301, confirms this. Using a suitable parameter for indicating proximity of separation, the likelihood of turbulent boundary layer separation in the nose region is demonstrated for these two airfoil sections. Author (ESA)

N81-21043# European Space Agency, Paris (France).
INVESTIGATION OF THREE-DIMENSIONAL SUBSONIC FLOW IN STRAIGHT CASCADES BY MEANS OF POTENTIAL FLOW CALCULATIONS AND EXPERIMENTS Ph.D. Thesis - Tech. Hochschule, Aix-la-Chapelle, West Germany
Juergen Renken Jan. 1981 165 p refs Transl. into ENGLISH of "Potentialtheoretische u. Experimentelle Untersuchung der Dreidimensionalen Unterschallstroemung in Geraden Verdichtergittern" DFVLR, Cologne Report DFVLR-FB-79-09
(ESA-TT-622; DFVLR-FB-79-09) Avail: NTIS HC A08/MF A01

Calculation methods for three dimensional, incompressible potential flow in straight cascades having arbitrarily shaped end walls are developed. A singularity model was constructed which represents the blades by means of vortex sheet elements and the end walls by means of source sheet elements. This method calculates the influence of blade height and end wall shape on the velocity distribution in the cascade mean section using a small amount of computer time. This model is extended to the three dimensional panel model by means of additionally introduced area sources (panels) and enables the calculation of fully three dimensional flow in the entire passage of the cascade with aerodynamic blade and wall interaction. Both methods are exemplified by means of two compressor cascades and are compared to one another and to quasi three dimensional methods. A parameter study demonstrates the influence of blade height, end wall contraction and end wall shape. A corresponding experiment provides test data on the surface pressure distribution in a passage of a compressor cascade. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N81-21044*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT PROGRESS TOWARDS PREDICTING AIRCRAFT GROUND HANDLING PERFORMANCE
Thomas J. Yager and Ellis J. White Mar. 1981 32 p refs Presented at the Aircraft Safety and Operating Probl. Conf., Hampton, Va., 5-7 Nov. 1980 Submitted for publication
(NASA-TM-81952; L-14354) Avail: NTIS HC A03/MF A01 CSCL 01C

Capability implemented in simulating aircraft ground handling performance is reviewed and areas for further expansion and improvement are identified. Problems associated with providing necessary simulator input data for adequate modeling of aircraft tire/runway friction behavior are discussed and efforts to improve tire/runway friction definition, and simulator fidelity are described. Aircraft braking performance data obtained on several wet runway surfaces are compared to ground vehicle friction measurements. Research to improve methods of predicting tire friction performance are discussed. E.A.K.

N81-21045*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT FATIGUE AND CIRCADIAN DESYNCHRONOSIS
Apr. 1981 19 p refs Workshop held in San Francisco, 26-28 Aug. 1980
(NASA-TM-81275; A-8528) Avail: NTIS HC A02/MF A01 CSCL 05H

Pilot fatigue and circadian desynchronosis, its significance to air transport safety, and research approaches, were examined. There is a need for better data on sleep, activity, and other pertinent factors from pilots flying a variety of demanding schedules. Simulation studies of flight crew performance should be utilized to determine the degree of fatigue induced by demanding schedules and to delineate more precisely the factors responsible for performance decrements in flight and to test solutions proposed to resolve problems induced by fatigue and desynchronosis. It was concluded that there is a safety problem of uncertain magnitude due to transmeridian flying and a potential problem due to fatigue associated with various factors found in air transport operations. E.A.K.

N81-21046# European Space Agency, Paris (France).
FLIGHT SAFETY OF ROGALLO HANG GLIDERS. THEORETICAL AND EXPERIMENTAL STUDY OF THE FLIGHT ENVELOPE
Claudius LaBurthe and Simon Walden Feb. 1981 260 p refs Transl. into ENGLISH of "Etude de Securite sur des Planeurs ultra-legers de Formule Rogallo. Aerodyn. et Mecan. du Vol", ONERA, Paris Rept. ONERA-NT-1979-8, 1979 Original report in FRENCH previously announced as ESA-93845
(ESA-TT-634; ONERA-NT-1979-8) Avail: NTIS HC A12/MF A01

Two series of full scale wind tunnel tests were completed on 15 hang gliders. The results were used to calculate the basic performance and stability characteristics and to analyze the critical limitations. The problem of pitching stability was investigated in detail. Implications of the results in areas such as take off, stall, dives, and settings are discussed. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N81-21047* *National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.*

AUTONOMOUS NAVIGATION SYSTEM Patent

Shmuel J. Merhav, inventor (to NASA) (NAS-NRC, Washington, D.C.) Issued 13 Jan. 1981 19 p Filed 24 Sep. 1979 Supersedes N79-33177 (17 - 24, p 3174) Sponsored by NASA (NASA-Case-ARC-11257-1; US-Patent-4,244,215; US-Patent-Appl-SN-078611; US-Patent-Class-73-178R; US-Patent-Class-73-490; US-Patent-Class-73-504) Avail: US Patent and Trademark Office CSCL 17G

An inertial navigation system utilizing a servo-controlled two *degree of freedom pendulum to obtain specific force components* in the locally level coordinate system is described. The pendulum includes a leveling gyroscope and an azimuth gyroscope *supported on a two gimbal system. The specific force components* in the locally level coordinate system are converted to components in the geographical coordinate system by means of a single *Euler transformation. The standard navigation equations are solved* to determine longitudinal and lateral velocities. Finally, vehicle position is determined by a further integration.

Official Gazette of the U.S. Patent and Trademark Office

N81-21048# Electromagnetic Compatibility Analysis Center, Annapolis, Md.

THE SUSCEPTIBILITY OF REPRESENTATIVE TACAN AND DME EQUIPMENTS TO A PROPOSED, MLS L-BAND PRECISION DME SIGNAL FORMAT Interim Report

Stephen J. Sutton, Gary A. Chopak, George W. Imhof, and Jack *Smithmyer* Aug. 1980 151 p *refs* FAA-RD-80-90 (Contracts F19628-78-C-0006; DOT-FA70WAI-175) (AD-A096265; ECAC-PR-77-031) Avail: NTIS *HC A08/MF A01 CSCL 17/7*

Measured data are presented that show the susceptibility of representative Tactical Air Navigation/Distance Measurement Equipments (TACAN/DME) to the proposed, Microwave Landing System (MLS) L-Band Precision DME (PDME) signal format. The interrogator data are examined to determine the most susceptible equipments, and the desired and undesired signal relationships that permit range and azimuth acquisition. Comments *are made on the transponder data.* GRA

N81-21049# Comsis Corp., Mountain View, Calif.

***ARTS 2 ENHANCEMENT DESIGN ALTERNATIVE STUDY* Final Report, Apr. - Dec. 1980**

M. Tashker, C. Isberg, N. Savage, and M. Bell Dec. 1980 88 p (Contract DTFA-01-80-Y-10510) (AD-A096276; CASS-MV-80-02; FAA-RD-81-7) Avail: NTIS HC A05/MF A01 CSCL 17/7

This report documents a study on an enchanced ARTS 2, to be known as ARTS 2A. ARTS 2A will include the following features: beacon tracking, minimum safe altitude warning (MSAW), conflict alert, and training target generator (TTG). In *addition, it will be compatible with various sensors and displays* now under development, such as ASR-9, Direct Address Beacon System (DABS), and Tower Cab Digital Display (TCDD). *The study considered the current capacity (memory and speed)* of the ARTS 2 computer as well as the requirements for the near-term enhancements. Various computer configurations were investigated for cost, ease of system development, implementation, and installation. A recommendation is made that the current *ARTS 2 computer be replaced with an LSI-2/40, a product of* computer automation Irvine, California. GRA

N81-21050# *Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.*

SRDS TECHNICAL PROGRAM DOCUMENT. FISCAL YEAR 1981. RESEARCH AND DEVELOPMENT APPROVED PROJECTS

Jan. 1981 121 p (AD-A096293; FAA/RD-81-3; ARD-443) Avail: NTIS HC A06/MF A01 CSCL 01/5

This Technical Program Document (TPD) contains Research and Technology sheets which reflect Systems Research and Development Service, Federal Aviation Administration, approved projects which have significant activity occurring in Fiscal Year 1981 and beyond. These sheets contain the requirement, participating organizations, specific objectives, and milestones scheduled for accomplishment. The dates identified are in effect as of the report date (1/06/81) and are subject to change. This TPD is structured according to the following Engineering and Development Programs: Radar, Beacon, Navigation, Airborne Separation Assurance, Communications, Approach and Landing Systems, Airport/Airside, Airport/Landside, En Route Control, *Flight Service Station, Terminal/Tower Control, Weather, Aircraft* Safety and Support. GRA

N81-21051# *Lockheed Missiles and Space Co., Palo Alto, Calif.* Palo Alto Research Lab.

PASSIVE IMAGERY NAVIGATION Final Technical Report, 15 Sep. 1978 - 15 Dec. 1980

O. Firschein, M. J. Hannah, D. L. Milgram, and C. M. Bjorklund 15 Dec. 1980 147 p *refs* (Contract F33615-78-C-1612; ARPA Order 3608) (AD-A096245; LMSC-D767313; AFWAL-TR-81-1044) Avail: NTIS HC A07/MF A01 CSCL 17/7

A passive navigation a small, low flying aircraft using passively sensed images of the ground, is described. A stereo pair is *derived from a single camera sensing the scene at two different* points on the flight path. A bootstrapping approach to position determination, starting with a set of known ground points and *projecting points forward from frame to frame, is described. The* landmark subsystem, used to correct the calculated position of the vehicle after a number of bootstrap iterations have been *performed, is an edge analysis approach that associates edges* into symchains that can be matched symbolically against a reference set of symchains for a known landmark. The major components of the bootstrapping procedure, the mechanics of operation and an error analysis obtained by simulation are discussed. J.D.H.

N81-21052# Mitre Corp., McLean, Va.

AN UPDATE OF THE DISCRETE ADDRESS BEACON SYSTEM (DABS) ALTERNATIVES STUDY

Marvin E. Kay and Martin T. Pozesky Sep. 1978 141 p refs (Contract DOT-FA78WA-4075) (AD-A096264; M78-75; FAA-RD-78-121) Avail: NTIS HC A07/MF A01 CSCL 17/7

This document is an update of an earlier 'Study of Alternative Beacon Based Surveillance and Data Link Systems.' It is based *on the numerous studies, analyses, simulations, and flight tests* conducted since the original study. The document uses the findings from that large body of work to summarize the rationale that *led to the selection and continued development of DABS +* ATARS + BCAS as the preferred approach to improving the surveillance, air-ground communications, and the collision *avoidance functions of the ATC system and provide the basis* for further improvements in the automation of the ATC system. Hypothetical scenarios heavily weighted in favor of the most competitive alternative, SAB + VHF D/L + ATARS, are presented as a basis for cost comparisons. DABS + ATARS + BCAS is *shown to be the most cost effective approach.* GRA

N81-21053# Mitre Corp., McLean, Va. Metrek Div.

***RESULTS OF AN ACTIVE BEACON COLLISION AVOIDANCE* EXPERIMENT CONDUCTED IN THE LOS ANGELES AIRSPACE**

Paul M. Ebert, Leonard T. Moses, and Ned A. Spencer May 1979 122 p refs *(AD-A096285; MTR-79W00158; FAA-RD-80-7) Avail: NTIS* HC A06/MF A01 CSCL 01/2

The Active BCAS test bed equipment, which had been tested *both at NAFEC and at Washington, D.C., was upgraded to include* the Whisper-Shout technique for garble reduction and the DABS mode for high integrity BCAS-to-BCAS operation. The test bed

was then flown in the environment of the Los Angeles TCA and of the Orange County Airport. A comparison was then made under various levels of traffic, and with various system features. *As a result of all of the tests on the feasibility equipment, general* performance results are predicted and improvements for future designs are given. GRA

N81-21054# Naval Postgraduate School, Monterey, Calif.
SENSITIVITY OF THE STEADY-STATE KALMAN FILTERS TO STABILITY DERIVATIVES VARIATIONS IN AN INERTIAL NAVIGATION SYSTEM M.S. Thesis
R. Jose Augusto Matallana Sep. 1980 103 p refs
(AD-A096393) Avail: NTIS HC A06/MF A01 CSCL 17/7

In a tactical missile with mid-course guidance, an Inertial *Navigation System (INS) is required. Strapdown INS using* Steady-State Kalman Filters (SKF) as estimators has been suggested and this kind of INS is considered to be easier and *cheaper to implement than the gimbaled INS. This thesis* investigates one aspect of the INS problem: The sensitivity of the SKF to inaccuracies in the filter parameters such as the *stability derivatives. The analysis has been performed by varying* each of the flight parameters over a given range and noting the effect on the accuracy of the filter. The great advantage of the *analysis in the sensitivity of rms estimate errors to inaccuracies* in the stability derivatives is that it points out clearly which derivatives are worthy of detailed accurate determination and *which are not.* GRA

N81-21055# Radar Evaluation Squadron (1954th), Hill AFB, *Utah.*
FINAL ACCEPTANCE TESTING OF THE TEXAS INSTRUMENTS (TI) ASR8/MTD (AN/GPN-25) AT TOLICHA PEAK, NEVADA
15 Oct. 1980 18 p
(AD-A096292) Avail: NTIS HC A02/MF A01 CSCL 17/7

The measured operational SCV for channel A was 41.54 dB with 90 percent confidence limits of 41.03 and 42.17 dB. The *corresponding SCV for channel B was 40.81 dB with 90 percent* confidence limits of 40.31 and 41.35 dB. The SCV channel A was measured with a Doppler offset of 634 Hz. This offset *placed the test signal at the peak of filter 4 for the 1266 PRF* and at the peak of filter 5 for the 1050 PRF. The channel B measurement was made with a Doppler offset of 570 Hz which *placed the test signal between filter peaks on both PRFs. Hence* the Channel B SCV was approximately 0.7 dB lower. The actual operational SCV should be a value somewhere between 41.54 *and 40.81 or approximately 41.2 dB. During the SCV testing,* Doppler filters were successively removed to determine which filters were producing scan modulation clutter. Doppler filters 1 *and 7 produced approximately 95 percent of the scan modulation* false targets from the MTD. The measured 75-percent SSPD detection range with a 2.6 dBsm aircraft at a true altitude of *16,300 feet and an active beam antenna tilt of 4.0 deg T was* 47.1 NM. After adjusting for power and noise figure deviations *from specified values, this equates to an on main-beam axis* 75-percent SSPD range of 68.27 NM. This investigation indicates that, different implementation techniques notwithstanding, the *TI implemented MTD is the equal in SCV and range performance* of the original Lincoln Laboratories MTD. GRA

N81-21056# *Institut fuer Angewandte Geodaesie, Frankfurt am* Main (West Germany).
ASSESSMENT OF THE PERFORMANCE OF A GRADIOMETER ASSISTED INERTIAL NAVIGATION SYSTEM Ph.D. Thesis - Tech. Univ., Munich [ABSCHAETZUNG DER LEISTUNGSFAEHIGKEIT VON GRADIOMETERUNTERSTUETZTEN INERTIALEN NAVIGATIONSSYSTEMEN]
Efstratios Doukakis 1979 95 p refs In GERMAN; ENGLISH *summary Sponsored by Deut. Akad. Austauschdienst*
(Ser-C-255; ISBN-3-7696-9307-8; ISSN-0065-5325) Avail: NTIS HC A05/MF A01

A gradiometer inertial navigation system is theoretically and statistically analyzed in order to estimate its capacity for monitoring in geocentric Cartesian coordinates. The inertial *instrument units used on the moving platforms are discussed,* and several reference coordinate systems applicable to all navigation systems are mentioned. The severe problem of the *separability of the gravity gradients from the inertial disturbances is studied. Computer simulation of the gradiometer assisted* navigation system onboard a moving vehicle is presented and the output of inertial coordinates is evaluated. Quantization error *is also analyzed. A second simulation is used to analyze the* accelerometer and gradiometer error models employed, and system estimation of geocentric coordinates is shown. Multipoint *statistical analysis of the approximated inertial acceleration* components demonstrates that the performance of the depicted navigation system improves closer reality is approached.
Author (ESA)

N81-21057# European Space Agency, Paris (France).
COLORED MEASUREMENT NOISE DIGITAL PREFILTERING BY AVERAGING
Rainer Froriep Dec. 1980 38 p refs Transl. into ENGLISH of "Digitale Vorfilterrung bei korrelierten Messtoerungen durch Mittelung" Rept. DFVLR-Mitt-79-08, DFVLR, Jul. 1979 Original *report in GERMAN previously announced as N80-25316*
(ESA-TT-640; DFVLR-Mitt-79-08) Avail: NTIS HC A03/MF A01

A digital prefilter for accelerating the fast initial fine alignment of an inertial platform with a Kalman filter is described. The prefilter averages sampled measurement data with correlated *noise data. The system operates with minimal storage require-*ments and only small computational effort. The choice of filter parameters is discussed using simulation techniques. The *algorithms for the online and offline calculations and for the* simulation are given. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.
For related information see also 18 Spacecraft Design, Testing and Performance and *39 Structural Mechanics.*

N81-21058*# Battelle Columbus Labs., Ohio.
***AIRCL: A PROGRAMMED SYSTEM FOR GENERATING* NC TAPES FOR AIRPLANE MODELS. USER'S MANUAL Final Report**
Nuri Akgerman and C. F. Billhardt Mar. 1981 40 p refs
(Contract NAS1-15090)
(NASA-CR-165687) Avail: NTIS HC A03/MF A01 CSCL 01C

A computer program is presented which calculates the cutter *location file needed to machine models of airplane wings or* wing-fuselage combinations on numerically controlled machine tools. Input to the program is a data file consisting of coordinates *on the fuselage and wing. From this data file, the program* calculates tool offsets, determines the intersection between wing and fuselage tool paths, and generates additional information *needed to machine the fuselage and/or wing. Output from the* program can be post processed for use on a variety of milling machines. Information on program structure and methodology is *given as well as the user's manual for implementation of the* program. R.C.T.

N81-21059*# General Dynamics/Fort Worth, Tex.
EXPERIMENTAL AND ANALYTICAL STUDY ON THE FLUTTER AND GUST RESPONSE CHARACTERISTICS OF A TORSION-FREE-WING AIRPLANE MODEL
Arthur C. Murphy Mar. 1981 145 p refs
(Contract NAS1-15412)
(NASA-CR-159283) Avail: NTIS HC A07/MF A01 CSCL 01C

Experimental data and correlative analytical results on the flutter and gust response characteristics of a torsion-free-wing (TFW) fighter airplane model are presented. TFW consists of a *combined wing/boom/canard surface and was tested with the* TFW free to pivot in pitch and with the TFW locked to the fuselage. Flutter and gust response characteristics were measured *in the Langley Transonic Dynamics Tunnel with the complete* airplane model mounted on a cable mount system that provided a near free flying condition. Although the lowest flutter dynamic pressure was measured for the wing free configuration, it was

only about 20 deg less than that for the wing locked configuration. However, no appreciable alleviation of the gust response was measured by freeing the wing. E.A.K.

N81-21060*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHARACTERISTICS OF FLIGHT SIMULATOR VISUAL SYSTEMS

Irving C. Statler, ed. Apr. 1981 89 p refs Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.

(NASA-TM-81278; A-8474) Avail: NTIS HC A05/MF A01 CSCL 01C

The physical parameters of the flight simulator visual system that characterize the system and determine its fidelity are identified and defined. The characteristics of visual simulation systems are discussed in terms of the basic categories of spatial, energy, and temporal properties corresponding to the three fundamental quantities of length, mass, and time. Each of these parameters are further addressed in relation to its effect, its appropriate units or descriptors, methods of measurement, and its use or importance to image quality. J.M.S.

N81-21061# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

VELOCITY CHARACTERISTICS OF THE FLOW IN MOTORED ENGINES Final Technical Report, Apr. 1979 - Jun. 1980

C. Arcoumanis, A. F. Bicen, A. D. Gosman, A. P. Morse, and J. H. Whitelaw Jun. 1980 55 p refs

(Grant DA-ERO-79-G-030; DA Proj. 1T1-61102-BH-57)

(AD-A095893) Avail: NTIS HC A04/MF A01 CSCL 21/7

Measurements of mean and rms values of axial velocity obtained with a laser anemometer, are reported for a swirling incompressible air flow in a piston-cylinder assembly motored at 200 rpm to quantify the influence of stroke and clearance. The results show that longer stroke causes the formation of stronger vortices while smaller clearance generates high turbulence levels at the early part of the intake stroke; in both cases vortices decay as the piston approaches BDC. Measurements of swirl velocities are also reported a diesel engine motored at 675 rpm with compression and 500 rpm without compression to quantify the influence of compression. The results show that the influence is insignificant in the intake stroke and the beginning of the compression stroke, but at higher crank angles the flow, under compression, tends towards solid body rotation. The experimental results in the non-compressing engine are compared with calculations obtained by numerical solution of the conservation equations and show that the major flow features are correctly predicted. GRA

N81-21062# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

JUH-1H ICE PHOBIC COATING ICING TESTS Final Report, Jan - Mar. 1980

Patrick M. Morris and Ralph Woratschek Jul. 1980 54 p refs

(AD-A096361; USAAEFA-79-02) Avail: NTIS HC A04/MF A01 CSCL 01/2

Artificial tests were conducted utilizing the helicopter icing spray system (hiss) with ambient temperatures ranging from 6 to 23 C, and relative humidities of 60 to 90 percent. Natural icing tests were conducted within the ambient temperature range of 2 to 12.5 C, with liquid water contents (lwc) ranging from 0.1 to 0.32 g m/cu m. The artificial icing tests verified proper operation of the test helicopter ice protection system for use as a safety device in subsequent tests. Natural icing tests were conducted to determine the operational potential of g 661 ice phobic compound and the gather data to aid in defining icing phenomenon and ice protection equipment design requirements. Excessive equipment and man-hour requirements degrade the particality of g661 use. GRA

N81-21063# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

ARTIFICIAL AND NATURAL ICING TESTS PRODUCTION UH-60A HELICOPTER Final Report , Feb. - Mar. 1980

Marvin L. Hanks, Larry B. Higgins, and Vernon L. Diekmann Jun. 1980 131 p refs

(AD-A096239; USAAEFA-79-19) Avail: NTIS HC A07/MF A01 CSCL 01/3

A limited evaluation of the production UH-60A Black Hawk anti-ice and deice systems was conducted to determine the capability to operate safely in a moderate icing environment. Artificial and natural icing tests were conducted at St. Paul, Minnesota, from 11 February through 31 March 1980. Testing was performed by the United States Army Aviation Engineering Flight Activity and consisted of 27.1 productive flight hours. During these tests, three deficiencies and fourteen shortcomings were noted. The two icing related deficiencies are: failure of the droop stops to return to the shutdown position after ice accumulation on the main rotor head and failure of the anti-flapping restrainers to return to the shutdown position after ice accumulation on the main rotor head. GRA

N81-21064# Atlantic Research Corp., Alexandria, Va.

IMPROVED BODIES OF REVOLUTION Final Technical Report, 28 Feb. - 28 May 1980

H. K. Schuman Jan. 1981 74 p refs

(Contract F30602-80-C-0087; AF Proj. 2064)

(AD-A096048; RADC-TR-80-389) Avail: NTIS HC A04/MF A01 CSCL 20/4

The aperture loading technique (ALT) is implemented in an aperture coupling body of revolution (BOR) computer code. Apertures of material fill (dielectric, composite, conductive putty, etc.) are amenable to ALT analysis. Thin apertures formed from complex shaped walls, e.g., sleeve-fit seams, also are amenable to ALT analysis. The ALT BOR code is applied to a plane wave excited, missile shaped BOR with a dielectric filled sleeve-fit seam. Interior E-fields and H-fields are mapped. GRA

N81-21065# Aeronautical Research Labs., Melbourne (Australia).

R.A.N. SEA KING CABIN ENVIRONMENT SURVEY. PART 2: MEASUREMENT OF TEMPERATURE AND HUMIDTY

B. Rebbechi and D. H. Edwards Nov. 1979 19 p refs

(AD-A096329; ARL/MECH-ENG-NOTE-377; AR-001-777) Avail: NTIS HC A02/MF A01 CSCL 01/3

Measurements of temperature and humidity have been made in a Royal Australian Navy Sea King over a period of four months. These measurements were carried out as part of a survey of the cabin environment which had been reported to be sufficiently adverse to cause impairment of crew efficiency, even when operating in moderate ambient temperatures. This survey has shown that the cabin temperature may be up to 12 C above the outside air temperature; this temperature differential, however, tends to decrease with increasing outside air temperature. Cabin wet bulb globe temperatures reached 32.3 C in an outside air temperature of 29 C. A WBGT level of 28 C is generally accepted as the level above which crew performance decreases; this level was reached at an outside air temperature of only 19 C. It is shown that operation of the Sea King to the extreme limits of outside environment such as the humid extremes of the Australian environment, or the United States MIL-STD-210B design environment (naval operations) would be quite impracticable, as it would be physiologically very hazardous to crew members. GRA

N81-21066# Joint Technical Coordinating Group for Aircraft Survivability, Washington, D.C. Design Criteria and Industry Interface Subgroup.

DIRECTORY OF AIRCRAFT SURVIVABILITY SPECIALISTS AND THEIR AFFILIATIONS

Dec. 1980 96 p

(AD-A096259) Avail: NTIS HC A05/MF A01 CSCL 05/2

A directory is presented which provides a comprehensive list of aircraft nonnuclear vulnerability/survivability specialists throughout the aerospace industry. Headings of mailing addresses for mailing through official channels to persons at the government agencies are included in this directory. R.C.T.

N81-21067# Naval Postgraduate School, Monterey, Calif.

CHALLENGE FOR OPERATIONAL EXPERIENCE FEEDBACK IN AIRCRAFT DESIGN: AN AIRCRAFT DESIGN EXAMPLE M.S. Thesis

Stanley John Swelkar, Jr. Sep. 1979 138 p refs

(AD-A096088; NPS54-79-019) Avail: NTIS

HC A07/MF A01 CSCL 01/3

Since the early 1960's, the Department of Defense and the air transport industry have seen a downward trend in the number of new aircraft production starts. One of the effects of fewer new development programs has been a declining level of practical design experience acquired by individual engineers in aerospace design organizations. When compared to the growing need for design experience build-up, a result of expanding technology, the situation becomes worse. To acquire needed levels of practical design experience, feedback and utilization of operational experience is becoming increasingly important. Responsive feedback systems are used by the commercial air transport industry for providing operational experience applicable to product improvement and new development programs. Feedback systems in Naval aviation provide data and information for application primarily in areas of manpower and material management. This thesis analyzes and discusses the present situation and basic needs for operational experience feedback in aircraft design. GRA

N81-21068# Quanta Systems Corp., Rockville, Md.

STUDY OF PILOT VISUAL INFORMATION REQUIREMENTS FOR NAVY VERTICAL TAKE-OFF AND LANDING CAPABILITY DEVELOPMENT

W. Scott Mitchell and Charles A. Douglas Lakehurst, N.J. NAEC 1 Jun. 1979 223 p refs

(AD-A096074; NAEC-MISC-91-OR019) Avail: NTIS HC A10/MF A01 CSCL 01/2

This report provides a comprehensive analysis of pilot visual landing aid requirements for operation of helicopters and V/STOL aircraft from ship and shorebased sites. The report is organized into eight sections starting with this introduction which further describes the requirement, background and approach to the study. The last four sections detail the terminology used to define pilot information, data tabulated as a result of pilot surveys, and typical existing VLA configurations. The analysis of the pilot data, evaluation of existing sources and identification of deficiencies are discussed in Section II for Helicopters and Section III for the AV-8A. The conclusions of the study, performance requirements, and recommendations are described in Section 4. GRA

N81-21069# Syracuse Research Corp., N. Y.

ADVANCED COMPOSITE AIRCRAFT ELECTROMAGNETIC DESIGN AND SYNTHESIS Interim Report, Sep. 1978 - May 1980

R. Wallenberg, G. Dike, J. Birken, J. Barrett, E. Burt, R Harrington, R. Rudolph, and L. Widmann May 1980 286 p refs

(Contracts N00014-78-C-0673; N00019-79-C-0172)

(AD-A096291; NAVAIR-518-1) Avail: NTIS HC A13/MF A01 CSCL 01/3

The construction of aircraft, missiles and helicopters with unprotected advanced composite materials increases their electromagnetic environment vulnerability. This is further aggravated by the diminishing susceptibility of high density digital devices (LSI, VLSI, and VHSIC) which are being utilized in the digital control systems. This study quantifies the threat to different devices in different composite airframes. It shows which composite materials exhibit the least vulnerability and initiates trade-offs to compensate it. Thin metal coatings are shown to significantly improve this with very small weight penalties for aluminum coatings. The use of coatings offers other desirable spin-offs, one being simple design composite structural joints exhibiting low electromagnetic vulnerability. GRA

N81-21070# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.

AIRCRAFT TRANSPARENCY OPTICAL QUALITY: NEW METHODS OF MEASUREMENT

Louis V. Genco and Harry L. Task Feb. 1981 31 p refs (AF Proj. 7184)

(AD-A096183; AFAMRL-TR-81-21) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report describes some traditional methods of measuring distortion in aircraft transparencies. A more expedient means of interpreting photographic distortion data via computerized digital analysis of the photo is also described. Finally, two new devices are introduced: one that measures angular deviation with extreme accuracy in a relatively small space and one that brings laboratory accuracy to field optical measurements. These latter devices employ state-of-the-art components and knowledge to provide extreme accuracy and usefulness. GRA

N81-21071# General Accounting Office, Washington, D. C. Mission Analysis and Acquisition Div.

REVIEW OF AIR FORCE'S NEXT GENERATION TRAINER AIRCRAFT PROGRAM DEPARTMENT OF DEFENSE

9 Feb. 1981 30 p

(AD-A096238; GAO/MASAD-81-2) Avail: NTIS HC A03/MF A01 CSCL 01/3

The Air Force's original plans effectively eliminated the Navy's current primary trainer aircraft, the T-34C, from consideration as its new primary trainer aircraft. GAO believes this elimination is inconsistent with OMB Circular A-109. This inconsistency has, however, been negated by recent congressional direction for the Air Force to evaluate the T-34C as an alternative. The Air Force could use the T-34V as its primary trainer. It does not, however, perform as well as the current primary trainer or well enough to meet the stated requirements for the new primary trainer. The relative cost effectiveness of various alternatives, including the T-34C is uncertain. One analysis prepared by a consultant for the Air Force showed that the T-34C would be the least costly alternative for the primary phase of the Air Force's undergraduate pilot training program, but would be the most costly alternative if the total program were considered. Uncertainty exists regarding some assumptions and cost data in the analysis. The Air Force is also considering a service life extension of its current primary trainer as an alternative to a new acquisition. GRA

N81-21072# General Accounting Office, Washington, D. C. Mission Analysis and Acquisition Div.

AIR FORCE AND NAVY PLANS TO ACQUIRE TRAINER AIRCRAFT

28 Feb. 1981 40 p

(AD-A096237; GAO/MASAD-81-11) Avail: NTIS HC A03/MF A01 CSCL 01/3

The Air Force and Navy plan to acquire four different aircraft for training missions. Total costs are expected to be several billion dollars. With one exception, the Air Force Next Generation Trainer and the Navy Undergraduate Jet Flight Training System acquisition programs are generally being conducted in accordance with Office of Management and Budget Circular A-109. The exception was that the requests for proposals/quotations for each program were too restrictive and precluded consideration of potential alternative solutions. Congressional interest and direction have been toward common aircraft for both the primary and advanced phases of the Navy and Air Force undergraduate pilot training programs. However, Air Force officials now believe there is little likelihood that the Air Force will use the Navy's advanced trainer aircraft. The Navy's use of the Air Force's primary trainer is also uncertain. GAO believes the Congress should explore the matter further with Defense. GRA

N81-21073# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Helicopter and Transport Div.

ACTIVE VIBRATION ISOLATION SYSTEM FOR HELICOPTERS. CONCEPT STUDIES INCLUDING TESTS ON A SINGLE-AXIS LABORATORY RESEARCH MODEL Final Report

Rainer Mehlhose and Matthias Bermayer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 213 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-48; ISSN-0170-1339) Avail: NTIS HC A10/MF A01

A generally applicable active vibration isolation system for helicopters which reduces the chief blade passage harmonic rotor disturbances is discussed. Two rotor isolation concepts are examined: (1) a fully active system with active disturbance rejection; and (2) a partially active system with conventional passive vibration isolation. Both systems include an automatic trim device to reduce quasistatic displacements between the fuselage and the rotor/transmission unit. Results show that multiaxis vibration, isolation with the fully active system is definitely more efficient than with the partially active system. Author (ESA)

N81-21074# *Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).*

STUDY OF OSCILLATORY AND FLIGHT DYNAMIC BEHAVIOR OF HELICOPTERS IN ATMOSPHERIC TURBULENCE

H. Dahl and D. Weger Bonn Bundesminister der Verteidigung 1980 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesminister der Verteidigung

(BMVG-FBWT-80-4) Avail: NTIS HC A04/MF A01

A statistical model was developed which takes the nonuniform nature of the gust velocity distribution into account together with the dynamic transient oscillation of the rotor blades. Because gust effects depend strongly on the helicopter's control behavior, an analytic pilot function is included in the considerations. Hingeless and hinged rotor systems are compared. Physiological factors and data acquisition are also discussed. The results enable gust reduction systems to be incorporated in the design of helicopters. Author (ESA)

N81-21075# Bristol Univ. (England). Dept. of Aeronautical Engineering.

A DESIGN STUDY OF THE DEPUTY B.S. Thesis

A. F. Klein and D. H. Leckey Jun. 1980 61 p refs

(BU-245) Avail: NTIS HC A04/MF A01

The feasibility of a single-engined derivative of the SHERIFF, a twin-engined aircraft was investigated. Maximum commonality between the two aircraft was considered of utmost importance throughout. The DEPUTY design calls for a 200 hp engine, a fixed undercarriage, and a maximum all up weight of 2550 lb. At this weight, maximum flight speed and maximum cruise speed are 151 and 137 mps, respectively. Although the design meets (BCA) requirements and offers reasonable handling characteristics, its overall performance is inferior to similar aircraft. When taken in the context of the present state of the single engine market, poor market potential is indicated. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-21076# Naval Postgraduate School, Monterey, Calif.

LOW-RANGE AIRSPEED SENSORS M.S. Thesis

Ralph E. Duncan Dec. 1980 99 p refs

(AD-A096359) Avail: NTIS HC A05/MF A01 CSCL 14/2

The work reported herein is comprised of two parts: A critical assessment of the existing low airspeed sensors for helicopters and V/STOL aircraft and the development of two-dimensional jet-interaction velocity sensors. The theory of operation, system description, associated electronics, advantages and disadvantages, and the development stage of the existing sensors (pitot-static system, optical convolution velocimeter, low-range orthogonal airspeed system, omnidirectional low-range airspeed sensor, swivelling probe air data system, and the fluidic velocity sensor) have been critically discussed. The need to develop a low-airspeed sensor with no moving parts and a relatively linear sensitivity throughout the operating range and without excessive electronic amplification of the pressure signal led to the exploration of the jet-interaction principle. This culminated in the development of a two-dimensional sensor with extremely encouraging results. Continued design and development will be required to bring the jet-interaction sensor to the point of field tests with helicopters and V/STOL aircraft. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N81-21077*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF SEMI-TRANSPORTATION-COOLED LINER IN HIGH-TEMPERATURE-RISE COMBUSTORS

Jerrold D. Wear, Arthur M. Trout, and John M. Smith Mar. 1981 20 p refs

(NASA-TP-1806; E-494) Avail: NTIS HC A02/MF A01 CSCL 21E

Results from tests with the Lamilloy combustor liner are compared with results obtained from a conventionally designed, film cooled, step-louver liner. Operation of the Lamilloy liner with counterrotating swirl combustor fuel modules with mixing venturis was possible to a fuel-air ratio of 0.065 without obtaining excessive liner metal temperatures. At the 0.065 fuel-air condition the average liner metal temperature was 140 K and the maximum local temperature 280 K above the inlet air temperature. Combustion efficiency, pattern factor, and smoke data are discussed. E.A.K.

N81-21078* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXHAUST EMISSION SURVEY OF AN F100 AFTERBURNING TURBOFAN ENGINE AT SIMULATED ALTITUDE FLIGHT CONDITIONS

John E. Moss and Richard R. Cullom Mar. 1981 28 p refs

(NASA-TM-81656; E-673) Avail: NTIS HC A03/MF A01 CSCL 21E

Emissions of carbon monoxide, total oxides of nitrogen, unburned hydrocarbons, and carbon dioxide from an F100, afterburning, two spool turbofan engine at simulated flight conditions are reported. For each flight condition emission measurements were made for two or three power levels from intermediate power (nonafterburning) through maximum afterburning. The data showed that emissions vary with flight speed, altitude, power level, and radial position across the nozzle. Carbon monoxide emissions were low for intermediate power (nonafterburning) and partial afterburning, but regions of high carbon monoxide were present downstream of the flame holder at maximum afterburning. Unburned hydrocarbon emissions were low for most of the simulated flight conditions. The local NOX concentrations and their variability with power level increased with increasing flight Mach number at constant altitude, and decreased with increasing altitude at constant Mach number. Carbon dioxide emissions were proportional to local fuel air ratio for all conditions. Author

N81-21079*# Lockheed-California Co., Burbank.

AERODYNAMIC AND ACOUSTIC BEHAVIOR OF A YF-12 INLET AT STATIC CONDITIONS Final Report

Louis H. Bangert, Edward P. Feltz, Larry A. Godby, and L. Dean Miller Jan. 1981 431 p refs Sponsored by NASA

(NASA-CR-163106; LR-29623) Avail: NTIS HC A19/MF A01 CSCL 21E

An aeroacoustic test program to determine the cause of YF-12 inlet noise suppression was performed with a YF-12 aircraft at ground static conditions. Data obtained over a wide range of engine speeds and inlet configurations are reported. Acoustic measurements were made in the far field and aerodynamic and acoustic measurements were made inside the inlet. The J-58 test engine was removed from the aircraft and tested separately with a bellmouth inlet. The far field noise level was significantly lower for the YF-12 inlet than for the bellmouth inlet at engine speeds above 5500 rpm. There was no evidence that noise suppression was caused by flow choking. Multiple pure tones were reduced and the spectral peak near the blade passing frequency disappeared in the region of the spike support struts at engine speeds between 6000 and 6600 rpm. J.D.H.

N81-21080# AiResearch Mfg. Co., Phoenix, Ariz.
REGENEATIVE ENGINE ANALYSIS PROGRAM (REAP) Final Report, Oct. 1979 - May 1980
R. W. Heldenbrand and W. S. Miller Jan. 1981 143 p
(Contract DAAK51-79-C-0057; DA Proj. 1L1-62209-AH-76)
(AD-A096113; Rept-21-3668; USAAVRADCOM-TR-81-D-2)
Avail: NTIS HC A07/MF A01 CSCL 21/5

This report presents the results of a 7-month program to conduct a preliminary design analysis of a 500-SHP fuel-efficient regenerative turboshaft engine and to identify promising heat exchanger concepts for such engines. A technology level consistent with that available in a 1980 demonstrator engine is assumed. Ninety engine/heat exchanger configuration and cycle combinations were examined. These included variations of compressor stage configuration, compressor pressure ratio, turbine design point inlet temperature, heat exchanger effectiveness, and heat-exchanger pressure loss. These engine combinations were evaluated and screened on the basis of fuel economy, weight and cost, and several promising configurations were chosen for more detailed analysis. The most promising of these was selected for preliminary design. The study results indicate that an engine configuration with a cycle pressure ratio of 10:1, a turbine temperature of 2300 F, and a heat exchanger with an effectiveness of 0.70 is most suitable for the 1980 environment. However, with fuel costs projected to increase, the analyses indicate that a tubular heat exchanger with an effectiveness approaching 0.80 would be more attractive. GRA

N81-21081# European Space Agency, Paris (France).
TURBINE ENGINE RESEARCH AND TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY, VOLUME 1
Alf Loeffler, H. Dissen, H. Doeker, R. Kochendoerfer, O. Lawaczeck, H. Meissenberg, P. Stottmann, H. Weyer, G. Winterfeld, and G. Wirth Sep. 1980 153 p refs Transl. into ENGLISH of "Triebwerkforsch. u. Technol. in der Bundersrepublik Deutschland, Band 1" DFVLR, Cologne Report DFVLR-Mitt-78-04-Vol-1, Dec. 1978 2 Vol.
(ESA-TT-601-Vol-1; DFVLR-Mitt-78-04-Vol-1) Avail: NTIS HC A08/MF A01

To judge the importance of engine technology to the economy of West Germany of a market analysis was made of the possible applications of stationary and mobile gas turbines, steam turbines, turbo-superchargers and compressors, with reference to the requirements for use. An inquiry by questionnaire and discussions with experts have provided the foundation for the description of the state of the art and the expected trends which provide a basis for the evaluation of a possible technological transfer. Aero and thermodynamics, materials and construction methods, engine control, and maintenance are covered. The main findings are that: (1) engine technology has an annual production value of 2 billion DM, and growth prospects are considered positive; (2) the pacemaker function of aircraft jet engines is confirmed; (3) the gas turbine still has considerable development potential, but further technical development will mainly be evolutionary; and (4) considerable technological transfer is taking place, but could be increased through improved information and cooperation. Author (ESA)

N81-21082# European Space Agency, Paris (France).
TURBINE ENGINE RESEARCH AND TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY, VOLUME 2
Alf Loeffler, H. Dissen, H. Doeker, R. Kochendoerfer, O. Lawaczeck, H. Meissenberg, P. Stottmann, H. Weyer, G. Winterfeld, and G. Wirth Sep. 1980 161 p refs Transl. into ENGLISH of "Triebwerkforsch. u. Technol. in der Bundesrepublik Deutschland, Band 2" DFVLR, Cologne Report DFVLR-Mitt-78-05-Vol-2, Dec. 1978 2 Vol.
(ESA-TT-602-Vol-2; DFVLR-Mitt-78-05-Vol-2) Avail: NTIS HC A08/MF A01

Supporting data and references are given for an investigation addressing the economic importance and development of the technology of gas turbines, steam turbines, turbosuperchargers, and turbocompressors in West Germany. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-21083*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLYING-QUALITIES CRITERIA FOR WINGS-LEVEL-TURN MANEUVERING DURING AN AIR-TO-GROUND WEAPON DELIVERY TASK Final Report
Robert I. Sammonds and John W. Bunnell (AFWAL) Apr. 1981 96 p refs
(NASA-TM-81266; A-8481) Avail: NTIS HC A05/MF A01 CSCL 01C

A moving base simulator experiment demonstrated that a wings-level-turn control mode improved flying qualities for air to ground weapon delivery compared with those of a conventionally controlled aircraft. Evaluations of criteria for dynamic response for this system have shown that pilot ratings correlate well on the basis of equivalent time constant of the initial response. Ranges of this time constant, as well as digital system transport delays and lateral acceleration control authorities that encompassed level 1 through 3 handling qualities, were determined. E.A.K.

N81-21084*# Blanchard (W. S., Jr.), Hampton, Va.
A FLIGHT INVESTIGATION OF THE ULTRA-DEEP-STALL DESCENT AND SPIN RECOVERY CHARACTERISTICS OF A 1/6 SCALE RADIOCONTROLLED MODEL OF THE PIPER PA38 TOMAHAWK Final Report
W. S. Blanchard, Jr. Mar. 1981 10 p refs
(NASA Order P-74271)
(NASA-CR-156871) Avail: NTIS HC A02/MF A01 CSCL 01C

Ultradeep stall descent and spin recovery characteristics of a 1/6 scale radio controlled model of the Piper PA38 Tomahawk aircraft was investigated. It was shown that the full scale PA38 is a suitable aircraft for conducting ultradeep stall research. Spin recovery was accomplished satisfactorily by entry to the ultradeep stall mode, followed by the exit from the ultradeep stall mode. It is concluded that since the PA38 has excellent spin recovery characteristics using normal recovery techniques (opposite rudder and forward control colum pressure), recovery using ultradeep stall would be beneficial only if the pilot suffered from disorientation. E.A.K.

N81-21085# Textron Bell Helicopter, Fort Worth, Tex.
FLY-BY-WIRE VERSUS DUAL MECHANICAL CONTROLS FOR THE ADVANCED SCOUT HELICOPTER: QUANTITATIVE COMPARISON Final Report
Gaylord W. Carlock and Kenneth F. Guinn Jan. 1981 168 p refs
(Contract DAAK51-79-C-0007; DA Proj. 1X4-64203-D-281)
(AD-A096089; USAAVRADCOM-TR-80-D-10) Avail: NTIS HC A08/MF A01 CSCL 01/3

A preliminary design study comparing fly-by-wire with dual mechanical controls for the Advanced Scout Helicopter was conducted by Bell Helicopter Textron. The purpose was to determine if significant payoffs were available in the utilization of fly-by-wire design concepts. Considered were flight safety and mission reliability; vulnerability; system reliability, availability, and maintainability; control system weight; electrical and hydraulic power supply requirements; initial and life-cycle costs; and predicted handling qualities. In addition, the study investigated the payoffs from the use of innovative thinking relative to cockpit controls. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N81-21086*# Computer Sciences Corp., Mountain View, Calif.
OPTICAL FIBER ILLUMINATION SYSTEM FOR VISUAL FLIGHT SIMULATION Final Report
Richard H. Hollow Washington NASA Apr. 1981 24 p refs
(Contract NAS2-9741)
(NASA-CR-3409) Avail: NTIS HC A02/MF A01 CSCL 01E

An electronically controlled lighting system simulating runway, aircraft carrier, and landing aid lights for flight simulations is described. The various colored lights that would be visible to a pilot by day, at dusk, or at night are duplicated at the distances the lights would normally become visible. Plastic optical fiber illuminators using tungsten halogen lights are distributed behind the model. The tips of the fibers of illuminators simulating runway lights are bevelled in order that they may be seen from long distances and at low angles. Fibers representing taxiway lights are pointed and polished for omni-directional visibility. The electronic intensity controls, which can be operated either manually or remotely, regulate the intensity of the lights to simulate changes in distance. A dichronic mirror, infrared filter system is used to maintain color integrity. J.D.H.

N81-21087*# Southampton Univ. (England).
MODEL AND BOUNDARY AERODYNAMIC DATA FROM HIGH BLOCKAGE TWO-DIMENSIONAL AIRFOIL TESTS IN A SHALLOW UNSTREAMLINED TRANSONIC FLEXIBLE WALLED TEST SECTION Semiannual Progress Report, period ending Oct. 1980
S. W. D. Wolf and M. J. Goodyer Apr. 1981 92 p refs
(Grant NsG-7172)
(NASA-CR-165685) Avail: NTIS HC A05/MF A01 CSCL 14B

Data for a NACA 0012-64 airfoil at Mach numbers of 0.3, 0.5, and 0.7 with the test section flexible walls set in the 'straight' position are presented because they may prove useful in the development of wind tunnel correction techniques. A.R.H.

N81-21088# Calspan Advanced Technology Center, Buffalo, N.Y.
ADAPTIVE-WALL WIND-TUNNEL INVESTIGATIONS Final Technical Report, 1 Nov. 1976 - 31 Oct. 1980
J. C. Erickson, Jr., C. E. Wittliff, C. Padova, and G. F. Homicz Feb. 1981 83 p refs
(Contract N00014-77-C-0052)
(AD-A096325; CALSPAN-RK-6040-A-2) Avail: NTIS HC A05/MF A01 CSCL 14/2

The results of a program of research on transonic wind tunnels with adaptive walls for eliminating wall interference are presented. A description is given of related experimental research performed at other laboratories using several alternative methods for controlling the flow. Features of the segmented plenum, perforated wall, two dimensional test section of the Calspan One foot Tunnel and the associated instrumentation for measuring the flow disturbance quantities are reviewed and necessary modifications made to the original experimental configuration are described. Details of adaptive-wall iteration experiments with a 4%-blockage NACA 0012 airfoil model are presented, particularly those at a free-stream Mach number of 0.9 and nominal angles of attack of 3, 2 and 1 deg. In these experiments, regions of supercritical flow terminated by shock waves extended to the tunnel walls. The results of the experiments indicate that successful iterations toward interference free flow conditions are achieved. For another phase of the research, conceptual design studies of a three dimensional transonic adaptive wall test section using the segmented plenum, perforated wall method of flow control are reported. Finally, numerical simulations of low speed flow within the Calspan test section, including the interaction of the transpired boundary layer at the walls with the flow over the model, are described in AIAA Paper No. 81-0160, which is appended to the report. GRA

N81-21089# Air Force Human Resources Lab., Brooks AFB, Tex. Operations Training Div.
TRAINING EFFECTIVENESS OF PLATFORM MOTION: REVIEW OF MOTION RESEARCH INVOLVING THE ADVANCED SIMULATOR FOR PILOT TRAINING AND THE SIMULATOR FOR AIR-TO-AIR COMBAT Final Report
Elizabeth L. Martin Feb. 1981 32 p refs
(AF Proj. 1123)
(AD-A095930; AFHRL-TR-79-51) Avail: NTIS HC A03/MF A01 CSCL 05/9

This report presents a summary review of the transfer-of-training studies conducted by the Operations Training Division of the Air Force Human Resources Laboratory investigating the training effectiveness of six-degrees-of-freedom platform motion cueing. A total of six studies are reviewed. Of the six studies, five were conducted on the Advanced Simulator for Pilot Training (ASPT) located at Williams AFB and one on the Simulator for Air-to-Air Combat (SAAC) located at Luke AFB. Tasks investigated included basic and advanced contact, instruments, basic fighter maneuvers, and conventional weapons delivery. The review of each study contains a statement of objectives, a summary of the method and results, a data excerpt representative of the findings, and a critique. The report also contains a description of the research strategy from which the studies were derived, a discussion of transfer-of-training methodology, and a discussion of the relationship between the results of these six studies and research findings from other agencies or facilities. Implications for future research are discussed. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-21090*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 27 Aug. - 15 Nov. 1977
15 Nov. 1977 194 p refs
(Contract NAS8-32742)
(NASA-CR-161693; NSS-SFDS-LR022; QPR-3) Avail: NTIS HC A09/MF A01 CSCL 22A

Progress on fabrication facility (beam builder) support structure control, clamp/weld block, and welding and truss cut off is discussed. The brace attachment design was changed and the design of the weld mechanism was modified which achieved the following system benefits: (1) simplified weld electrode life; (2) reduced weld power requirements; and (3) simplified brace attachment mechanisms. Static and fatigue characteristics of spot welded 2024T3 aluminum joints are evaluated. E.A.K.

N81-21091*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 16 Nov. 1977 - 15 Feb. 1978
16 Feb. 1978 41 p refs
(Contract NAS8-32472)
(NASA-CR-161694; NSS-SFDS-LR028; QPR-4) Avail: NTIS HC A03/MF A01 CSCL 22A

Progress in the mechanical/structural assembly of the beam builder is reported. The following structures were investigated: cross brace magazine/dispenser subsystem; and rolling mill supply reel, guide, and drive. The fabrication facility design and a detail design of all major subsystem components are discussed. The number of spot welds per structural joint were reduced which enables the doubling of length of truss which can be produced within known electrode life limits. E.A.K.

N81-21092*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 16 Feb. - 15 May 1978
15 May 1978 127 p refs
(Contract NAS8-32472)
(NASA-CR-161695; NSS-SFDS-LR040; QPR-5) Avail: NTIS HC A07/MF A01 CSCL 22A

The completion of assembly of the beam builder and its first automatic production of truss is discussed. A four bay, hand assembled, roll formed members truss was built and tested to ultimate load. Detail design of the fabrication facility (beam builder) was completed and designs for subsystem debugging are discussed. Many one bay truss specimens were produced to demonstrate subsystem operation and to detect problem areas. E.A.K.

N81-21093*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 16 Sep. - 15 Dec. 1978
30 Dec. 1978 20 p refs
(Contract NAS8-32472)
(NASA-CR-161705; NSS-SFDS-LR069; QPR-6) Avail: NTIS HC A02/MF A01 CSCL 22A

The lower right aluminum beam cap roll forming mill was delivered and installed in the beam builder. The beam was brought to full operational status and beams of one to six bay lengths were produced to demonstrate full system capability. Although the cap flange waviness problem persists, work is progressing within cost and schedule. A.R.H.

N81-21094*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 17 May - 26 Aug. 1977
30 Aug. 1977 132 p refs
(Contract NAS8-32472)
(NASA-CR-161706; NSS-SFDS-LR013; QPR-2) Avail: NTIS HC A07/MF A01 CSCL 22A

Progress in the development of a beam builder to be deployed by space shuttle for assembly of large structures in space is reported. The thermal coating for the structural truss was selected and the detail truss design and analysis completed. Data acquired during verification of the design of the basic 'building block' truss are included as well as design layouts for various fabrication facility subsystems. J.M.S.

N81-21095*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 16 Sep. - 15 Dec. 1979
3 Jan. 1980 11 p refs
(Contract NAS8-32472)
(NASA-CR-161704; QPR-10) Avail: NTIS HC A02/MF A01 CSCL 22A

The development effort on the composite beam cap fabricator was completed within cost and close to abbreviated goals. The design and analysis of flight weight primary and secondary beam builder structures proceeded satisfactorily but remains curtailed until further funding is made available to complete the work. The induction fastening effort remains within cost and schedule constraints. Tests of the LARC prototype induction welder is continuing in an instrumented test stand comprised of a Dumore drill press (air over oil feed for variable applied loads) and a dynamometer to measure actual welding loads. Continued testing shows that the interface screening must be well impregnated with resin to ensure proper flow when bonding graphite-acrylic lap shear samples. Specimens prepared from 0.030 inch thick graphite-polyethersulfone are also available for future induction fastening evaluation. A.R.H.

N81-21096# Oesterreichische Akademie der Wissenschaften, Vienna.
SPACE ACTIVITY IN AUSTRIA, 1979 TO 1980
E. Mondre, ed. Apr. 1980 27 p refs Presented at 23rd COSPAR Plenary Meeting, Budapest, 2-14 Jun. 1980
Avail: NTIS HC A02/MF A01

Participation in Spacelab programs, research in aeronomy, magnetospheric physics and microwave propagation are reported. The latitudinal structure of the ionospheric electron content, high latitude geomagnetic disturbances and solar wind geomagnetic field interactions were studied. Use was made of data from TIROS N LANDSAT, and NOAA 5 for synoptic and climatic studies. Lunar samples and carbonaceous chondrites were examined in petrological and planetary research. The Spacelab experiments were planned in the solidification of lead zinc alloys, as well as solar oblateness measurements. Author (ESA)

N81-21097# Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany). Inst. fuer Werkstoffwissenschaften.
EFFECT OF SURFACE LAYERS ON SPACELAB MELTING EXPERIMENTS Final Report
Siegfried Hofmann and Eckehard Fromm Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-45; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

Two methods for the removal of oxide layers from metallic melts in Spacelab experiments are reviewed. Results from the literature are analyzed and estimations of reaction behavior based on thermochemical data were made. The theoretical considerations were checked by extended experiments in relevant metal oxygen systems. The experiments covered: (1) chemical reduction of oxides by H2 or C which can be transported to the surface of the specimen, i.e., annealing in C2H2; and (2) sputtering with Ar ions. Sputtering requires more apparatus and is therefore appropriate only for the removal of stable oxides, a case where chemical methods fail. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N81-21098*# General Electric Co., Philadelphia, Pa. Re-Entry Systems Div.
GENERIC AEROCAPTURE ATMOSPHERIC ENTRY STUDY, VOLUME 1 Final Report
24 Oct. 1980 241 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955609)
(NASA-CR-164161; JPL-9950-514-Vol-1; GE80SDR2226-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 22A

An atmospheric entry study to fine a generic aerocapture vehicle capable of missions to Mars, Saturn, and Uranus is reported. A single external geometry was developed through atmospheric entry simulations. Aerocapture is a system design concept which uses an aerodynamically controlled atmospheric entry to provide the necessary velocity depletion to capture payloads into planetary orbit. Design concepts are presented which provide the control accuracy required while giving thermal protection for the mission payload. The system design concepts consist of the following elements: (1) an extendable biconic aerodynamic configuration with lift to drag ratio between 1.0 and 2.0; (2) roll control system concepts to control aerodynamic lift and disturbance torques; (3) aeroshell design concepts capable of meeting dynamic pressure loads during aerocapture; and (4) entry thermal protection system design concepts to meet thermodynamic loads during aerocapture. E.A.K.

N81-21099*# General Electric Co., Philadelphia, Pa. Re-entry Systems Div.
GENERIC AEROCAPTURE ATMOSPHERIC ENTRY STUDY. VOLUME 2: TRAJECTORY APPENDICES Final Report
24 Oct. 1980 159 p refs Prepared for JPL
(NAS7-100; JPL-955689)
(NASA-CR-164160; JPL-9950-Vol-2; GE80SDR2226-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 22A

Aerothermodynamic and control system parameters and performance are discussed. Aerocapture trajectories were run for several combinations of entry path angles and velocities for the SO2P, MSR, and Uranus missions. The SO2P trajectories represent a Titan atmospheric entry for orbit about Saturn; the MSR trajectories represent a Mars atmospheric entry for orbit about Mars; similarly, the Uranus trajectories enter an Uranus atmosphere to achieve orbit about Uranus. E.A.K.

N81-21100# Centre National d'Etudes Spatiales, Toulouse (France). Dept. of Operations.
THE REENTRY OF SKYLAB: REENTRY TRACKING OPERATIONS SUPPORT [SKYLAB. SUIVI DE LA RENTREE DU POINT DE VUE OPERATIONS]
J. C. Caroff, J. Y. Trebol, I. Legoff, and J. Sculfort 31 Aug.

1979 198 p In FRENCH and ENGLISH Report will also be announced as transaction (ESA-TT-692)
(CNES-CT/EMT/OPS/O/079) Avail: NTIS HC A09/MF A01

French contribution to the final tracking of Skylab is reported. Specifically, interagency collaboration within the French scientific community and French cooperation with NASA are detailed. Global tracking operations organization is described and the tracking equipment used is cited. A rundown of significant events affecting operations support over the final 24 hr of Skylab orbital lifetime is presented. An eyewitness account (Skylab public release information No. 19) of the vehicle reentry and breakup is quoted. A chronological recapitulation of messages exchanged the French space agency and NASA is also given. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-21101*# Essex Corp., Huntsville, Ala.
STRUCTURAL ATTACHMENTS FOR LARGE SPACE STRUCTURES Final Report
Edwin C. Pruett, Thomas E. Loughead, and Kem B. Robertson, III 15 Oct. 1980 42 p
(Contract NAS8-33599)
(NASA-CR-161685; H-80-04) Avail: NTIS HC A03/MF A01 CSCL 22B

The feasibility of fabricating beams in space and using them as components of a large, crew assembled structure, was investigated. Two projects were undertaken: (1) design and development of a ground version of an automated beam builder capable of producing triangular cross section aluminum beams; and (2) design and fabrication of lap joints to connect the beams orthogonally and centroidal end caps to connect beams end to end at any desired angle. The first project produced a beam building machine which fabricates aluminum beams suitable for neutral buoyancy evaluation. The second project produced concepts for the lap joint and end cap. However, neither of these joint concepts was suitable for use by a pressure suited crew member in a zero gravity environment. It is concluded that before the beams can be evaluated the joint designs need to be completed and sufficient joints produced to allow assembly of a complex structure. E.A.K.

N81-21102*# General Electric Co., Philadelphia, Pa. Re-Entry Systems Div.
TEST OF CHARGE INJECTION DEVICE, PHASE 1 Final Report, 15 Oct. 1980 - 15 Mar. 1981
A. Gradinger, M. B. Sayles, D. Peters, and P. Buckley Mar. 1981 24 p refs
(Contract NAS8-33952)
(NASA-CR-161701) Avail: NTIS HC A02/MF A01 CSCL 14B

A computer-controlled automatic facility containing two interactive microprocessors, peripherals, and an optical bench was used to obtain device characteristics for use in evaluating CID's as the sensor element in a prospective star tracker application. Each of the ST-256 chips tested contains a 256 x 256 pixel element array with 65536 picture elements. Two ST-256 devices were tested at 20 C under light levels of 10%, 0.1%, and 0.01% saturation, and in darkness. The saturation level was established at 0.95 microwatts sq cm as measured by the radiometeric sensor. Two test runs under each condition were performed for each chip. Two complete sets of data for each of the devices were thus obtained. A separate data field was used to store the results of each test condition. Repetitive runs of a test condition were stored sequentially in the same file. Examination of the data using print-outs is shown in examples. A.R.H.

N81-21103# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatiale.
DEFINITION OF A TRANSIENT VIBRATION TEST PERFORMED ON A SHAKE REGIME SIMULATOR [DEFINITION D'UN ESSAI DE VIBRATION SUR EXCITATEUR EN REGIME TRANSITOIRE]
A. Girard 20 Aug. 1979 9 p In FRENCH; ENGLISH summary
(CNES-79/CT/PRT/SST/SM/248) Avail: NTIS HC A02/MF A01

The simulation of rocket launch vehicle shaking due to propellant combustion instability is considered. Specifically, the simulation of transient vibration excitations at the last stage/payload mechanical interface is envisaged for the analysis of coupling effects. The feasibility of the testing scheme is supported by results from a preliminary test, using a typical payload mock up and a shake test apparatus. Comparison and Fourier analysis of shock spectra, both measured on the shake tester and obtained from ARIANE ground tests of thrust decay, show that the test setup is capable of simulating any transient vibration mode which may be encountered onboard ARIANE. Author (ESA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-21104* National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS EXPLORER TWIN SPACECRAFT UNDER EVALUATION TESTS
Charles Redmond 13 Mar. 1981 4 p
(NASA-News-Release-81-35; P81-10035) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

The Dynamics Explorer A and B satellites designed to explore the interactive processes occurring between the magnetosphere and Earth's ionosphere, upper atmosphere, and plasmasphere are described. Effects of these interactions, satellite orbits, data collecting antennas, solar power systems, axes, configurations, and Earth based command, control and data display systems are mentioned. J.D.H.

N81-21105*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF THE AEROS SATELLITE PROGRAM: SUMMARY
P. Lammerzahl, K. Rawer, and N. Roemer Oct. 1980 23 p refs Transl. into ENGLISH of "Ergebnisses des AEROS-satellitenprogramms" Rept. MPI H-1980-V3 Heidelberg, Dec. 1979 p 7-9 and 253-270 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Max-Planck Inst. for Nuclear Physics, Heidelberg
(Contract NASw-3199)
(NASA-TM-76438) Avail: NTIS HC A02/MF A01 CSCL 22A

Published literature reporting aeronomic data collected on two AEROS missions is summarized. The extreme ultraviolet solar radiation and other significant parameters of the thermosphere/ionosphere were investigated. Kinetic pressure, the quantity of atomic nitrogen, and partial densities of helium, oxygen, nitrogen, argon, and atomic nitrogen were determined. The thermal electron population, superthermal energy distribution, plasma density, ion temperature, and composition according to ion types were measured. The chief energy supply in the thermosphere was calculated. Aeronomic calculations showing that variations in the parameters of the ionosphere cannot be correlated with fluctuations of extreme ultraviolet solar radiation were performed. The AEROS data were compared with data from S3-1, ISIS, and AE-C satellites. Models of the thermosphere and ionosphere were developed. J.D.H.

N81-21106*# Vought Corp., Dallas, Tex.
STUDY OF THERMAL MANAGEMENT FOR SPACE

PLATFORM APPLICATIONS
John A. Oren Dec. 1980 184 p refs Prepared in cooperation with Hughes Aircraft Co., Los Angeles, TRW Systems, Redondo Beach, Calif., Hamilton Standard, Hartford, Conn., General Dynamics/Astronautics, San Diego, Calif., and Lockheed Missiles and Space Co., Sunnyvale, Calif.
(Contract NAS3-22270)
(NASA-CR-165238; Rept-2-53020/OR-52578) Avail: NTIS HC A09/MF A01 CSCL 22B

Techniques for the management of the thermal energy of large space platforms using many hundreds of kilowatts over a 10 year life span were evaluated. Concepts for heat rejection, heat transport within the vehicle, and interfacing were analyzed and compared. The heat rejection systems were parametrically weight optimized over conditions for heat pipe and pumped fluid approaches. Two approaches to achieve reliability were compared for: performance, weight, volume, projected area, reliability, cost, and operational characteristics. Technology needs are assessed and technology advancement recommendations are made. E.A.K.

N81-21107# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PRELIMINARY RESULTS FROM THE P78-2 SATELLITE Interim Report
Joseph F. Fennell and Donald R. Croley, Jr. 2 Feb. 1981 32 p refs
(Contract F04701-80-C-0081)
(AD-A096297; TR-0081(6960-06)-6; SD-TR-81-8) Avail: NTIS HC A03/MF A01 CSCL 22/2

Several particle instruments and a pair of spherical probes on three meter booms, built by The Aerospace Laboratories are in orbit aboard the P78-2 spacecraft. The experiments are briefly described and several examples of preliminary observations are presented and discussed. The probe measurements have shown that the P78-2 spacecraft frame potential changes as it rotates because the area of the illuminated grounded conductors varies as different portions of the spacecraft become sunlit. The probes have also measured the spacecraft potential during several onboard accelerator operations. The particle analyzers have observed the acceleration of the ambient plasma during artificially induced spacecraft charging events. The particle experiments have also measured the natural environment. One set of observations shows the occurrence of field aligned ions at energies of a few hundred eV/q. The angular distributions of these ions peak near 0 deg and 180 deg in pitch angle. These and other observations will be discussed. GRA

N81-21108# Naval Surface Weapons Center, Dahlgren, Va. Space and Surface Systems Div.
A NEW COLLAPSING TECHNIQUE FOR STAR IDENTIFICATION USING SENSORS WITH NONSIMULTANEOUS ACQUISITION TIMES Final Report
Jeffrey N. Blanton Oct. 1980 13 p refs
(AD-A096242; NSWC/TR-80-330) Avail: NTIS HC A02/MF A01 CSCL 17/7

A new stellar image mapping technique based on a state transition matrix form of solution for the rotational motion of a satellite is described. This technique allows star hits observed by an on-board sensor over a period of time to be effectively collapsed to an instantaneous photograph. When good rate gyro samples of the angular velocity are available, this collapsing is rigorous. GRA

N81-21109# Applied Systems Studies, Coventry (England).
AN APPRAISAL OF LINEAR SYSTEMS THEORY WITH APPLICATIONS TO ATTITUDE CONTROL. REPORT TO ESTEC
P. E. Crouch, A. J. Pritchard, N. Carmichael, and C. Lobry Paris ESA May 1980 201 p refs
(Contract ESTEC-3771/78/NL-AR(SC))
(ESA-CR(P)-1392) Avail: NTIS HC A10/MF A01

Nonlinear system theory was reviewed with the emphasis on its relevance to significant attitude control problems in stability and in controllability with a limited number of torques. Suitably chosen attitude control systems were studied in order to produce detailed conclusions of import to realistic design and synthesis requirements. In the general framework of systems analysis nonlinear differential equations were handled with the notion of a differentiable manifold along with all its geometric and analytic ramifications. The fundamental concepts were outlined in a manner accessible to most engineers. Global asymptotically stabilizing controls for two types of actuator system were defined, and controllability criteria for both two torques and one torque by gas jets were set. Author (ESA)

N81-21110# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Stabilisation-Equipements.
THE ARIANE LAUNCH VEHICLE: PYROTECHNIC SYSTEMS DEFINITION [LANCEUR ARIANE: DEFINITION DES SYSTEMES PYROTECHNIQUES]
J. P. Bouloumie Dec. 1980 142 p In FRENCH Original contains color illustrations
(CNES-80/CT/PRT/SST/SE/314) Avail: NTIS HC A07/MF A01

Pyrotechnic systems requirements considered during the design and development of the ARIANE launch system are analyzed. Pyrotechnic functions are defined, and the associated sequential control and safety systems are identified. Pyrotechnic functions specific to payload separation are emphasized. The system for releasing the payload from the final stage, and control of the injection impulse, are described. Electropyrotechnic subsystems are diagrammed, and pyrotechnic component characteristics are given. Inspection, assembly, initiator simulation, arming, and checkout operations at the Guyana Space Center are then detailed, and improvements to ARIANE pyrotechnics are discussed. Author (ESA)

N81-21111# European Space Agency, Paris (France).
A METHOD OF PRODUCING ANALYTICAL ORBIT MODELS FOR GEOSTATIONARY SATELLITES
Martin Eckstein Dec. 1980 28 p refs Transl. into ENGLISH of "Ein Verfahren zur Herstellung analytischer Bahnmodelle fuer Geostationaere Satelliten" Rept. DFVLR-FB-79-16, DFVLR, Aug. 1979 Original report in GERMAN previously announced as N80-25366
(ESA-TT-643; DFVLR-FB-79-16) Avail: NTIS HC A03/MF A01

A simplified perturbation theory of nearly geostationary satellites is described. The analytical form of the perturbations is derived from geometrical considerations and the coefficients are determined using multiple Fourier analysis. The resulting single formula avoids singularities for zero eccentricity and inclination. A computer program is used to evaluate the formula.
Author (ESA)

N81-21112# British Aerospace Dynamics Group, Bristol (England).
INFLUENCE ON MODELING ERRORS ASSOCIATED WITH THE ATTITUDE RECONSTITUTION FOR SPIN-STABILIZED SATELLITES IN ORDER TO PROVIDE OPTIMAL ESTIMATION TECHNIQUES Final Report
V. R. Wood and T. A. Morley Paris ESA Jun. 1980 190 p refs
(Contract ESOC-3325/77)
(ESS/SS/1007; ESA-CR(P)-1399) Avail: NTIS HC A09/MF A01

One method employed for spinning spacecraft attitude reconstitution from albedo fan beam sensor measurements is the extended Kalman filter. The filter measurement residuals from the COS B satellite were investigated. It is concluded that deficiencies in the filter system model exist and an alternative filter solution is sought. Current filtering methods based upon Kalman theory were surveyed, and an alternative method, i.e., the J adaptive filter, was chosen. Rigorous testing of the J adaptive filter reveal considerable areas of weakness in this application. A further parametric study based on geometric considerations was conducted. Results show that it was not possible to isolate a single cause or causes which consistently explain the observed behavior of the residuals. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-21113# General Accounting Office, Washington, D. C. Mission Analysis and Acquisition Div.

DOD PARTICIPATION IN THE SPACE TRANSPORTATION SYSTEM. STATUS AND ISSUES

28 Feb. 1981 56 p

(AD-A096236; GAO/MASAD-81-6) Avail: NTIS HC A04/MF A01 CSCL 05/1

The Space Transportation System has been delayed 3-1/2 years and the cost of Defense participation in the program has increased $1.6 billion--from about $1.2 billion in fiscal year 1978 to about $2.8 billion in fiscal year 1982. To date, the delays have not resulted in any known operational degradation in Defense space capabilities . Continuing uncertainties, however, may further delay Defense's use of the full capabilities offered by the System, increase costs, or degrade future defense operational capabilities in space. The Secretary of Defense and the Administrator of the National Aeronautics and Space Administration should inform the Congress of the options being considered for maintaining an assured launch capability for defense and civil missions and the key assumptions, costs, and risks associated with each option. The Secretary of Defense should also provide the Congress information on the total cost of Defense participation in the Space Transportation System program. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N81-21114# Rolls-Royce Ltd., Derby (England).

TELEMETRY: INSTRUMENTATION ON RAPIDLY ROTATING AERO ENGINE PARTS

P. H. Riley 1980 6 p refs

(PNR-90038) Avail: NTIS HC A02/MF A01

The measurement of both slowly and rapidly changing quantities such as temperature, static and dynamic strain at 27,000 g and elevated temperatures, is discussed. The causes of interference in telemetry of moving parts include phase modulation, transducer wire pickup, amplitude modulation of the recieved RF signal, and frequency modulation of the transmitter. Techniques for reducing interference are explained. Aluminum bond wires must be used in microcircuits subject to high levels of acceleration. High temperature design considerations for active and passive components include thick film technology, dielectric isolation, and printed ceramic and aluminum capacitors.

Author (ESA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-21115*# Bendix Corp., Teterboro, N. J. Guidance Systems Div.

IUE/IRA SYSTEM DESCRIPTION Final Report

J. Jennings 8 Sep. 1977 105 p

(Contract NAS5-20081)

(NASA-CR-166652) Avail: NTIS HC A06/MF A01 CSCL 22B

The IUE/IRA rate sensor system designed to meet the requirements of the International Ultraviolet Explorer spacecraft mission is described. The system consists of the sensor unit containing six rate sensor modules and the electronic control unit containing the rate sensor support electronics and the command/control circuitry. The inertial reference assembly formed by the combined units will provide spacecraft rate information for use in the stabilization and control system. The system is described in terms of functional description, operation redundancy performance, mechanical interface, and electrical interface. Test data obtained from the flight unit are summarized. J.D.H.

N81-21116*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PERFORMANCE OF A HAYNES 188 METALLIC STANDOFF THERMAL PROTECTION SYSTEM AT MACH 7

Don E. Avery Apr. 1981 44 p refs

(NASA-TP-1802; L-13903) Avail: NTIS HC A03/MF A01 CSCL 22B

A flight weight, metallic thermal protection system (TPS) model applicable to reentry and hypersonic vehicles was subjected to multiple cycles of both radiant and aerothermal heating to evaluate its aerothermal performance and structural integrity. The TPS was designed for a maximum operating temperature of 1255 K and featured a shingled, corrugation stiffened corrugated skin heat shield of Haynes 188, a cobalt base alloy. The model was subjected to 3 radiant preheat/aerothermal tests for a total of 67 seconds and to 15 radiant heating tests for a total of 85.9 minutes at 1255 K. The TPS limited the primary structure to temperatures below 430 K in all tests. No catastrophic failures occurred in the heat shields, supports, or insulation system. The TPS continued to function even after exposure to a differential temperature 4 times the design value produced thermal buckles in the outer skin. The shingled thermal expansion joint effectively allowed for thermal expansion of the heat shield without allowing any appreciable hot gas flow into the model cavity, even though the overlap gap between shields increased after several thermal cycles. S.F.

N81-21117# Consulenze Generali Roma (Italy).

STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS. PART 1: SURVEY OF MISSIONS Final Report

Carlo Arduini and Ugo Ponzi Paris ESA Apr. 1980 262 p refs 3 Vol.

(Contract ESTEC-3959/79/NL-AK)

(ESA-CR(P)-1385-Vol-1) Avail: NTIS HC A12/MF A01

Large space systems planned missions, proposals, and concepts were surveyed through NASA and industry documents and through the general literature. Large space structures (LSS) and their interfaces with other subsystems are characterized in order to establish trends and boundaries of feasibility. Particular construction problems are identified and preliminary mechanical requirements of predefined categories of LSS are provided. These categories include structural members (columns), attachments, and joints. Categories related to the configuration of various design problems are then established in reference to mission forms. These cover solar power, telecommunications, Earth sensing, astronomy, demonstration missions, and multipurpose missions. Author (ESA)

N81-21118# Consulenze Generali Roma (Italy).

STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS. PART 2: SURVEY OF PROBLEMS Final Report

Carlo Arduini and Ugo Ponzi Paris ESA Apr. 1980 307 p 3 Vol.

(Contract ESTEC-3959/79/NL-AK)

(ESA-CR(P)-1385-Vol-2) Avail: NTIS HC A14/MF A01

Large space structures (LSS) and their interfaces with other subsystems were studied in order to identify the most important design and construction problems. Together with the presentation of the problems, analytical indexes intended to quantify LSS

feasibility are introduced and discussed. The problem survey covers five main categories: (1) operational load conditions; (2) structural problems, including testing techniques; (3) control problems; (4) thermal problems; and (5) problems concomitant with orbit transfer and propulsion. Author (ESA)

N81-21119# Consulenze Generali Roma (Italy).
STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE STRUCTURES. PART 3: CHARACTERIZATION AND SYNTHESIS Final Report
Carlo Arduini and Ugo Ponzi Paris ESA Apr. 1980 256 p refs 3 Vol.
(Contract ESTEC-3954/79/NL-AK)
(ESA-CR(P)-1385-Vol-3) Avail: NTIS HC A12/MF A01

Indexes of technology feasibility are applied to different mission configurations in order to provide a nonempirical quantization of the realization complexity for a given large space structure (LSS). The meaning and limitations of the mission selection are considered. The indexes are recalled and summarized while their significance, their applicability and their use for generating LSS categories are explained. The characterization diagrams are presented and extensively discussed. They provide the basis for the classification which is founded on morphological as well as on functional characteristics of the systems. The characteristic families and twenty morphological/functional categories are proposed. The main mechanical requirements for each category are then logically associated to the characteristics indexes so that a table of typical technological development requirements results. The most important near term development areas, thus identified, are briefly outlined. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N81-21120# Officine Galileo S.p.A., Florence (Italy).
STUDY OF A YAW SUN SENSOR Final Report
A. Buccheri and F. Cavallini (Osservatorio Astrofis. di Arcetri) *Paris ESA Feb. 1980 142 p refs*
(Contract ESTEC-1345/77/NL-AK(SC))
(ESA-CR(P)-1396; Rept-402-DT-2) Avail: NTIS *HC A07/MF A01*

A solar reference was used to derive altitude information in two axes as well as for the third axes (yaw). A wide variety of sun features were analyzed in order to identify those potentially capable of providing yaw information. Results are reported.
Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also 07 Aircraft Propulsion, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

N81-21121*# *National Aeronautics and Space Administration.* Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF 30-CENTIMETER MERCURY ION *THRUSTERS*
Joseph E. Maloy, Robert L. Poeschel (Hughes Research Lab., Malibu, Calif.), and Carl R. Dugeroff (Hughes Research Lab., *Malibu, Calif.*) 1981 24 p refs Presented at 15th Intern. Elec. Propulsion Conf., Las Vegas, Nevada, 21-23 Apr. 1981; *sponsored by AIAA, Japan Society for Aeronautical and Space* Sciences and DGLR
(NASA-TM-81706; E-735) Avail: NTIS HC A02/MF A01 CSCL 21C

The technology development of the 30 centimeter J series mercury ion thruster for prime propulsion application in solar electric propulsion systems is described. Thruster design is reviewed. A standardized set of test and data recording procedures formulated to allow for the characterization of the J series thruster is described. Characteristics measured are the magnetic baffle characterization, the neutralizer characterization, perveance, the minimum eV/ion measurement, and the electrical and propellant utilization efficiency measurements. Test results are presented.
J.D.H.

N81-21122*# Aerojet Liquid Rocket Co., Sacramento, Calif.
LOW-THRUST CHEMICAL ROCKET ENGINE STUDY Final Contractor Report
J. A. Mellish Mar. 1981 152 p refs
(Contract NAS3-21940)
(NASA-CR-165276) Avail: NTIS HC A08/MF A01 CSCL 21H

Engine data and information are presented to perform system studies on cargo orbit-transfer vehicles which would deliver large space structures to geosynchronous equatorial orbit. Low-thrust engine performance, weight, and envelope parametric data were established, preliminary design information was generated, and technologies for liquid rocket engines were identified. Two major engine design drivers were considered in the study: cooling and engine cycle options. Both film-cooled and regeneratively cooled engines were evaluated. The propellant combinations studied were hydrogen/oxygen, methane/oxygen, and kerosene/oxygen. T.M.

N81-21123*# Physical Sciences, Inc., Woburn, Mass.
LASER-HEATED THRUSTER Interim Report, 1 Sep. 1978 - 31 Aug. 1979
N. H. Kemp and P. F. Lewis Feb. 1980 178 p refs
(Contract NAS8-33097)
(NASA-CR-161665; PSI-TR-205) Avail: NTIS HC A09/MF A01 CSCL 21H

The development of a computer program for the design of the thrust chamber for a CW laser heated thruster was examined. Hydrodgen was employed as the propellant gas and high temperature absorber. The laser absorption coefficient of the mixture/laser radiation combination is given in temperature and species densities. Radiative and absorptive properties are given to determine radiation from such gas mixtures. A computer code for calculating the axisymmetric channel flow of a gas mixture *in chemical equilibrium, and laser energy absorption and convective* and radiative heating is described. It is concluded that: (1) small amounts of cesium seed substantially increase the absorption *coefficient of hydrogen;* (2) cesium is a strong radiator and contributes greatly to radiation of cesium seeded hydrogen; (3) water vapor is a poor absorber; and (4) for 5.3 mcm radiation, both H2O/CO and NO/CO seeded hydrogen mixtures are good absorbers. E.A.K.

N81-21124*# Physical Sciences, Inc., Woburn, Mass.
LASER-HEATED THRUSTER Final Report, 1 Sep. 1979 - *10 Aug. 1980*
N. H. Kemp and R. H. Krech Sep. 1980 157 p refs
(Contract NAS8-33097)
(NASA-CR-161666; PSI-TR-220) Avail: NTIS HC A08/MF A01 CSCL 21H

The development of computer codes for the thrust chamber of a rocket of which the propellant gas is heated by a CW laser beam was investigated. The following results are presented: *(1) simplified models of laser heated thrusters for approximate* parametric studies and performance mapping; (3) computer programs for thrust chamber design; and (3) shock tube experiment *to measure absorption coefficients. Two thrust chamber design* programs are outlined: (1) for seeded hydrogen, with both low temperature and high temperature seeds, which absorbs the laser *radiation continuously, starting at the inlet gas temperature;* and (2) for hydrogen seeded with cesium, in which a laser supported combustion wave stands near the gas inlet, and heats the gas up to a temperature at which the gas can absorb the laser energy. E.A.K.

N81-21125*# Rocketdyne, Canoga Park, Calif.
LOW-THRUST CHEMICAL ROCKET ENGINE STUDY Final *Progress Report, Jul. 1979 - Nov. 1980*
J. M. Shoji Mar. 1981 340 p refs

(Contract NAS3-21941)
(NASA-CR-165275; RI/RD80-237) Avail: NTIS HC A15/MF A01 CSCL 21H

An analytical study evaluating thrust chamber cooling engine cycles and preliminary engine design for low thrust chemical rocket engines for orbit transfer vehicles is described. Oxygen/hydrogen, oxygen/methane, and oxygen/RP-1 engines with thrust levels from 444.8 N to 13345 N, and chamber pressures from 13.8 N/sq cm to 689.5 N/sq cm were evaluated. The physical and thermodynamic properties of the propellant theoretical performance data, and transport properties are documented. The thrust chamber cooling limits for regenerative/radiation and film/radiation cooling are defined and parametric heat transfer data presented. A conceptual evaluation of a number of engine cycles was performed and a 2224.1 N oxygen/hydrogen engine cycle configuration and a 2224.1 N oxygen/methane configuration chosen for preliminary engine design. Updated parametric engine data, engine design drawings, and an assessment of technology required are presented. J.D.H.

N81-21126*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY, PHASE A, EXTENSION 1: VOLUME 2: STUDY RESULTS Final Report
J. A. Mellish Mar. 1981 242 p refs
(Contract NAS8-32999)
(NASA-CR-161699; Rept-32999-F-E1) Avail: NTIS HC A11/MF A01 CSCL 21H

Because of the advantage of the Advanced Expander Cycle Engine brought out in initial studies, further design optimization and comparative analyses were undertaken. The major results and conclusion derived are summarized. The primary areas covered are (1) thrust chamber geometry optimization, (2) expander cycle optimization, (3) alternate low thrust capability, (4) safety and reliability, (5) development risk comparison, and (6) cost comparisons. All of the results obtained were used to baseline the initial design concept for the OTV Advanced Expander Cycle Engine Point Design Study. J.M.S.

N81-21127# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardthausen (West Germany). Abteilung Energie und Antriebe.
THEORETICAL CONSIDERATIONS OF BORON COMBUSTION IN DUCTED ROCKETS
Dirk Meinkoehn and Juergen Bergmann Aug. 1980 64 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-703)
(DFVLR-FB-80-26) Avail: NTIS HC A04/MF A01

The use of elemental boron as a fuel component for a ducted rocket motor design is considered. The design consists of a primary gas generator and an air breathing secondary chamber for the afterburning of the boron-rich exhaust from the primary chamber. The primary chamber is conceived as a hybrid gas generator with nitric acid as the oxidizer and a solid fuel containing a high percentage of elemental boron. This design concept is characterized by the inherent advantage of a possible thrust modulation via the control of the oxidizer flow. It is shown that boron combustion ignition and satisfactory combustion efficiency require high gas temperatures. This can be achieved by primary combustion of a fraction of the total boron fuel. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-21128*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
RESEARCH IN ACETYLENE CONTAINING MONOMERS Semiannual Progress Report, Jun. - Dec. 1978
Michael A. Ogliaruso 1978 25 p refs
(Grant NsG-1286)
(NASA-CR-164151) Avail: NTIS HC A02/MF A01 CSCL 07C

The preparation of precursor bisbenzils with pendant acetylene linkages for use in the synthesis of new aromatic poly (phenyl quinoxalines) was investigated. Attempts to condense para, para prime-dibromo benzil and potassium acetylide in liquid ammonia and in toluene, to prepare 4-phenyl acetyl phenyl ether, 4-(paraacetylphenyl) acetyl phenyl ether, 4-phenyl acetyl-4 primeacetyl phenyl acetyl phenyl ether, the reaction of 4-phenyl acetyl phenyl ether with Villsmeier reagent to prepare 4-(beta-chloro cinnamaldehyde) phenyl ether, the reaction of 4-(para-acetyl phenyl) acetyl phenyl ether with Villsmeier reagent, and the oxidation of bibenzil to prepare benzil are described. The reactions of phenyl acetylene with oxidizing agent, of phenyl acetylene with bromine, of 1,1,2,2-tetrabromo ethyl benzene with zinc and with oxidizing agent are described. J.D.H.

N81-21129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM APPLICATIONS RESEARCH. A SUMMARY OF LEWIS RESEARCH CENTER PROGRAMS
Bruce A. Banks 1981 73 p refs Presented at 15th Intern. Elec. Propulsion Conf., Las Vegas, 21-23 Apr. 1981; sponsored by AIAA, Japan Soc. for Aeron. and Space Sci., and DGLR
(NASA-TM-81721; E-756) Avail: NTIS HC A04/MF A01 CSCL 20H

A summary of the ion beam applications research (IBAR) program organized to enable the development of materials, products, and processes through the nonpropulsive application of ion thruster technology is given. Specific application efforts utilizing ion beam sputter etching, deposition, and texturing are discussed as well as ion source and component technology applications. E.D.K.

24 COMPOSITE MATERIALS

Includes laminates.

N81-21130*# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Textile Fibers Dept.
ULTRA-HIGH MODULUS ORGANIC FIBER HYBRID COMPOSITES
A. R. Champion 15 Mar. 1981 103 p refs
(Contract NAS3-21837)
(NASA-CR-165228; RSC-3697-6) Avail: NTIS HC A06/MF A01 CSCL 11D

An experimental organic fiber, designated Fiber D, was characterized, and its performance as a reinforcement for composites was investigated. The fiber has a modulus of 172 GPa, tensile strength of 3.14 GPa, and density of 1.46 gm/cu cm. Unidirectional Fiber D/epoxy laminates containing 60 percent fiber by volume were evaluated in flexure, shear, and compression, at room temperature and 121 C in both the as fabricated condition and after humidity aging for 14 days at 95 percent RH and 82 C. A modulus of 94.1 GPa, flexure strength of 700 MPa, shear strength of 54 MPa, and compressive strength of 232 MPa were observed at room temperature. The as-fabricated composites at elevated temperature and humidity aged material at room temperature had properties 1 to 20 percent below these values. Combined humidity aging plus evaluated temperature testing resulted in even lower mechanical properties. Hybrid composite laminates of Fiber D with Fiber FP alumina or Thornel 300 graphite fiber were also evaluated and significant increases in modulus, flexure, and compressive strengths were observed. E.D.K.

N81-21131# Boeing Commercial Airplane Co., Seattle, Wash.
THE 737 GRAPHITE COMPOSITE FLIGHT SPOILER FLIGHT SERVICE EVALUATION Annual Report, May 1979 - Apr. 1980
Daniel J. Hoffman Nov. 1980 45 p refs
(Contract NAS1-11668)
(NASA-CR-159362; AR-6) Avail: NTIS HC A03/MF A01 CSCL 11D

Tests of removed spoilers after the sixth year of service continue to indicate modest changes in composite strength properties. Two spoilers were tested after 6 years of service, and both had residual strengths that fell within the original static strength scatter band. Both of these units had typical service

included discrepancies when tested. Based on visual, ultrasonic, and destructive inspection there continues to be no evidence of moisture migration into the honeycomb core and no core corrosion in the deployed units. The 2 year task to gather in flight moisture absorption data was completed this past year. Data are now available from these exterior mounted specimens that had been deployed on three of the participating airlines. The coupons show rational weight trends. A.R.H.

N81-21132*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FINITE ELEMENT ANALYSIS OF INSTABILITY-RELATED DELAMINATION GROWTH
John D. Whitcomb Mar. 1981 46 p refs
(NASA-TM-81964) Avail: NTIS HC A03/MF A01 CSCL 11D

A parametric study of postbuckled through-width delaminations in laminated coupons was performed. A finite element analysis was developed to analyze the coupons as a combination of linear and geometrically nonlinear components. Because most of the coupon configuration studied behaves linearly, the mixed linear and nonlinear analysis greatly reduced computational costs. The analysis was verified by comparing numerical with exact solutions for simple hypothetical problems. In addition, measured lateral deflections of postbuckled through-width delaminations in laminated coupons were compared with predicted deflections. In the parametric study, stress distributions and strain-energy release rates were calculated for various delamination lengths, delamination depths, applied loads, and lateral deflections. Also, a small number of coupons with through-width delaminations were fatigue tested to obtain delamination growth data. Calculated strain-energy release rates were compared with the observed growth rates to determine the relative importance of the Mode 1 and Mode 2 components of energy release. Growth process was dominated by G sub I. Author

N81-21133*# Rockwell International Corp., Downey, Calif. Space Div.
POROUS TOOLING PROCESS FOR MANUFACTURE OF GRAPHITE/POLYIMIDE COMPOSITES Final Report
L. W. Smiser, K. K. Orr, and S. M. Araujo Jan. 1981 97 p refs
(Contract NAS1-15501)
(NASA-CR-165633; SSG-80-0005) Avail: NTIS HC A05/MF A01 CSCL 11D

A porous tooling system was selected for the processing of Graphite/PMR-15 Polyimide laminates in thickness up to 3.2 mm. (0.125 inch). This tool system must have a reasonable strength, permeability dimensional stability, and thermal conductivity to accomplish curing at 600 F and 200 psi and 200 psi autoclave temperature and pressure. A permeability measuring apparatus was constructed and permeability vs. casting water level determined to produce tools at three different permeability levels. On these tools, laminates of 5, 11, and 22 plies (.027, .060, and 0.121 inch) were produced and evaluated by ultrasonic, mechanical, and thermal tests to determine the effect of the tool permeability on the cured laminates. All tools produced acceptable laminates at 5 and 11 plies but only the highest permeability produced acceptable clear ultrasonic C-Scans. Recommendations are made for future investigations of design geometry, and strengthening techniques for porous ceramic tooling. Author

N81-21134*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSICAL AGING IN GRAPHITE EPOXY COMPOSITES
Eric S. W. Kong (Stanford Univ.) Apr. 1981 25 p refs
(NASA-TM-81273; A-8495) Avail: NTIS HC A02/MF A01 CSCL 11D

The matrix dominated mechanical behavior of a graphite epoxy composite was found to be affected by sub Tg annealing. Postcured + or - 45 deg 4S specimens of Thornel 300 graphite/Narmco 5208 epoxy were quenched from above Tg and given a sub Tg annealing at 140 C for times up to 10 to the 5th power min. The ultimate tensile strength, strain to break, and toughness of the composite material were found to decrease as functions of sub Tg annealing time. No weight loss was observed during the sub Tg annealing. The time dependent change in mechanical behavior is explained on the basis of free volume changes that are related to the physical aging of the nonequilibrium glassy network epoxy. The results imply possible changes in composite properties with service time. Author

N81-21135*# *Clemson Univ., S.C. Dept. of Mechanical* Engineering.
FRACTURE AND CRACK GROWTH IN ORTHOTROPIC *LAMINATES Annual Report*
James G. Goree 15 Oct. 1980 101 p refs
(Grant NsG-1297)
(NASA-CR-164183) Avail: NTIS HC A06/MF A01 CSCL 11D

Solutions are developed for the two dimensional region containing unidirectional fibers with initial damage in the form of a notch, a rectangular cut out, and a circular hole. An ultimate stress failure criterion is used for both the fibers and the matrix, simple tension for the fibers, and shear failure for the matrix. Models which account for longitudinal matrix yielding and splitting as well as transverse matrix yielding and fiber breakage as a function of initial damage, material properties, and applied stress are presented. For ductile matrix composites the results indicate that longitudinal matrix yielding and transverse notch extension are the most significant forms of damage. The extent of the stable transverse damage is shown to be approximately constant, independent of initial notch length. In the case of brittle matrix composites (graphite/epoxy) longitudinal splitting is shown to be the dominant form of damage. J.M.S.

N81-21136# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
EPOXY RESIN DEVELOPMENT FOR COMPOSITE FIELD REPAIR Final Report
L. J. Buckley and R. E. Trabocco 8 Oct. 1980 52 p refs
(AD-A096273; NADC-80128-60) Avail: NTIS HC A04/MF A01 CSCL 11/4

An evaluation was conducted to determine the optimum polymer matrix material to be used for composite repair. The material must have room temperature storage and adequate strength at elevated temperatures. Mechanical property degradation due to moisture absorption was also a consideration. Differential scanning calorimetry and dynamic mechanical analyses were performed on the candidate resin systems. Short beam shear and flexural strengths were examined for each system. The most promising resin systems proved to be stable at room temperature in the B-stage condition. These systems incorporated a sterically hindered amine hardener that provided latency. The effects of cloth style on void content and shear properties were also examined. GRA

N81-21137# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
PROGRESSIVE MATRIX DAMAGE IN LAMINATED FIBER-EPOXY FLYWHEEL DISCS
R. P. Nimmer Mar. 1980 67 p
(Contract W-7405-eng-48)
(UCRL-15306) Avail: NTIS HC A04/MF A01

An effort is made to identify realistic mechanisms to describe the failure of laminated discs. One mechanism which provides insight into early test failures is associated with damage to the epoxy matrix of the laminate rather than the embedded fibers. The analysis and rationale of this mode of failure is described and compared with experiment. Large percentages of the laminated flywheels made from both S2 glass and graphite epoxy incur matrix damage at speeds much below the ultimate failure speed. This prediction is corroborated by ultrasonic C scans conducted on test wheels before and after spin tests. This damage which spreads rapidly over the disc as the speed of the flywheel increases may be one of the contributing factors to the failures of the test wheels observed to date. DOE

N81-21138# Sandia Labs., Albuquerque, N. Mex.
FIBER CONTENT IN MOLDED DC-302 COMPOSITES
Ralph E. Trujillo Jan. 1981 32 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2514) Avail: NTIS HC A03/MF A01

A method of analyzing molded silicone parts for fiber content, particulate content, and silicone resin content was developed.

The method involves dissolving the silicone resin component of the cured DC-302 part in pyrrolidine and separating this solubilized resin from the pyrrolidine insoluble glass fiber and particulate components by filtration. The glass fiber is separated from the particulate matter through microsieves. The fibers are retained on the sieves during this washing procedure. This method permits the determination of percent resin, percent fiber, and percent particulate in molded DC-302 parts. Data from molded DC-302 parts analyzed by this technique suggest that fiber content distribution can be a major factor in defining part strength and crack propensity. DOE

N81-21139# Forschungsinstitut Berghof G.m.b.H., Tuebingen (West Germany).

PRODUCTION OF IMPROVED SILICON CARBIDE FILAMENTS FOR COMPOSITE MATERIALS Final Report

Philip Gruber Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 24 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-177; ISSN-0340-7608) Avail: NTIS HC A02/MF A01

Three possibilities for reducing the manufacturing costs of silicon carbide filament were investigated. The results indicate that (1) the conventional tungsten substrate can be replaced by a less expensive carbon substrate. The results further indicate that the production rate of the filament can be increased by employing a longer reactor. The third possibility for cost reduction, suggested that the tensile strength of a body increases with its cross section, is seen as unworkable. In fact, for larger diameter filaments, the tensile strengths of the filaments are less than sufficient. Nonetheless, employing the carbon substrate in conjunction with the higher production rate, as estimated savings of 50% in large scale production costs, compared to the previous state of the art, is projected. Author (ESA)

N81-21140# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

INFLUENCE OF MOISTURE CONTENT ON THE TRANSVERSE STRENGTH OF DIFFERENT UNIDIRECTIONAL CARBON/EPOXY LAMINATES

W. G. J. Thart Jan. 1980 25 p refs

(Contract NIVR-1744)

(NLR-TR-80012-U) Avail: NTIS HC A02/MF A01

Tensile tests were performed at room temperature, at 333 K and 358 K on 90 deg composite laminates (T300/Narmco 550, T300/code 92 and T300/code 69) after 264 hr immersion in water. The theory of moisture absorption using Ficks law of diffusion was reviewed. Water absorption was measured by weighing and electrical resistance measurements. Maximum moisture content for Code 92, Code 69 and Narmco 550 laminates was 1%, 1.75% and 3.05%, respectively. Measurement of the electrical conductivity appeared to be a quick method to check the moisture content of Code 69 and Narmco 550. The tensile strength of the Code 92 and Narmco 550 laminates strongly depended on the moisture content. Code 69 laminates are superior in strength to Narmco 550 and Code 92 laminates in the temperature range of 320 K to 360 K. Since no influence of moisture content on the fracture strain was observed, the reduction in fracture strength with increasing moisture content is essentially connected with a decrease of the modulus of elasticity.

Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N81-21141# National Aerospace Lab., Tokyo (Japan).

A NUMERICAL APPROACH TO FUEL DROPLET IGNITION

Takashi Niioka, Shinichi Ishiguro, and Takeo Saitoh Sep. 1980 9 p refs

(NAL-TR-628T) Avail: NTIS HC A02/MF A01

Ignition time of a fuel droplet suddenly placed in a hot oxidant atmosphere is calculated numerically. Solutions derived from the unsteady equation set, show a characteristic temperature and concentration variation with time, prior to ignition. Ignition time increases as droplet size increases for a droplet initially at room temperature, but not for one of high initial temperature. Although the ignition time of a semi-infinite condensed fuel generally diverges to the infinity in the vicinity of the ignitable limit, the limit of a droplet appears rather suddenly when the ambient temperature drops or droplet diameter decreases. In addition, the effect of a small amount of fuel vapor fraction in a hot oxidant atmosphere is investigated. Author

N81-21142*# National Aeronautics and Space Administration, Washington, D. C.

CHEMISTRY OF PEROXIDE COMPOUNDS

I. I. Volnov Apr. 1981 14 p refs Transl. into ENGLISH from Issled. Teorii Prikl. Neorgan. Khimii (Moscow), 1971 p 344-352

(Contract NASw-3199)

(NASA-TM-76541) Avail: NTIS HC A02/MF A01 CSCL 07D

The history of Soviet research from 1866 to 1967 on peroxide compounds is reviewed. This research dealt mainly with peroxide kinetics, reactivity and characteristics, peroxide production processes, and more recently with superoxides and ozonides and emphasis on the higher oxides of group 1 and 2 elements. Solid state fluidized bed synthesis and production of high purity products based on the relative solubilities of the initial, intermediate, and final compounds and elements in liquid ammonia are discussed. E.D.K.

N81-21143*# College of William and Mary, Williamsburg, Va.

INSULATORS FOR Pb(1-x)Sn(x)Te Final Report

Yuan-Huai Tsuo and Arden Sher 20 Apr. 1981 5 p

(Grant NsG-1653)

(NASA-CR-164175) Avail: NTIS HC A02/MF A01 CSCL 07A

Thin films of LaF3 were e-gun and thermally deposited on several substrates. The e-gun deposited films are fluorine deficient, have high ionic conductivities that persist to 77 K, and high effective dielectric constants. The thermally deposited material tends to be closer to stoichiometric, and have higher effective breakdown field strengths. Thermally deposited LaF3 films with resistivities in excess of 10 to the 12th power ohms - cm were deposited on metal coated glass substrates. The LaF3 films were shown to adhere well to PbSnTe, surviving repeated cycles between room temperature and 77 K. The LaF3 films on GaAs were also studied. Author

N81-21144*# Unidynamics/Phoenix, Ariz.

DEVELOPMENT, QUALIFICATION, AND DELIVERY OF A HYDROGEN BURNOFF IGNITER Final Report

D. Ray 24 Mar. 1981 37 p refs

(Contract NAS8-34195)

(NASA-CR-161703; DTR-149) Avail: NTIS HC A03/MF A01 CSCL 21B

The hydrogen burnoff igniter, a pyrotechnic device used to burn off excess hydrogen gas near the Space Shuttle Main Engine (SSME) nozzle, was designed, fabricated, and qualified. Characteristics of the burnoff igniter include a function time of 8 + or - 2 seconds, a minimum three foot flame length at maximum output, and hot particles projected 15 feet when fired directly into or perpendicular to a 34.5 knot wind. The three foot flame length was considered to be of questionable importance, since the hot particles are the media for igniting the hydrogen. Flame temperature is greater than 1500 F. J.M.S.

N81-21145# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistic Research Lab.

LASER RAMAN SPECTROSCOPY OF FLAMES: THEORY AND PRELIMINARY RESULTS

J. A. Vanderhoff and R. A. Beyer Jan. 1981 38 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A096195; AD-E430569; ARBRL-TR-02279) Avail: NTIS

HC A03/MF A01 CSCL 07/4

A Raman spectroscopy apparatus using intracavity argon ion laser excitation and photon counting detection has been used to measure both pure rotational and rotational-vibrational spectra of N2 from room temperature up to approximately 2200 K using pure gas samples, methane-air, and methane-nitrous oxide flames. Synthetic spectra generated by computer have been used to extract temperatures from the rotational-vibrational data using peak height ratios. GRA

N81-21146# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

DETECTION OF HYDRAZINE IN AIR USING ELECTRON TRANSFER IONIZATION MASS SPECTROMETRY Interim Report

P. Breisacher, P. Mahadevan, and W. A. Hicks 15 Feb. 1981 21 p refs

(Contract F04701-80-C-0081)

(AD-A095952; TR-0081(6940-01)-6; SD-TR-81-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

A simple direct analytical method for the detection of hydrazine (N2H4) in air is described. The N2H4 is ionized in electron transfer collisions with a low kinetic energy projectile ion (H(-)) under well-controlled conditions in a collision chamber. A single product ion is formed. Interference by background air is not observed. The product ion is detected using a quadrupole mass spectrometer. Preliminary estimates of the detection sensitivity of the present instrument configuration for N2H4 are discussed. GRA

N81-21147# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

REDUCTIVE ELIMINATION OF H-H, H-CH3, AND CH-3-CH3 FROM BIS(PHOSPHINE)PLATINUM (2), PALLADIUM(2), AND NICKEL(2) COMPLEXES: A THEORETICAL STUDY USING THE SCF-X ALPHA-SW METHOD Interim Report

Anna C. Balazs, Keith H. Johnson, and George M. Whitesides 4 Mar. 1981 42 p refs

(Contract N00014-75-C-0970; NR Proj. 056-596)

(AD-A096408; TR-14) Avail: NTIS HC A03/MF A01 CSCL 07/3

Self-consistent-field X alpha scattered-wave (SCF-X alpha-SW) calculations have been carried out for two series of organometallic complexes (L = H3P: L2PtH2, L2Pt(H)CH3, and L2Pt(CH3)2; L2Ni(CH3)2, L2Pd(CH3)2, and L2Pt(CH3)2. These calculations suggest a correlation between the relative rates of reductive elimination (L2MXY yields L2M - XY) and the molecular orbital character of the starting complexes: those compounds which eliminate XY relatively rapidly have occupied molecular orbitals with pronounced M-X(Y) antibonding character: those which eliminate XY slowly have only vacant M-X(Y) antibonding orbitals. No single orbital (HOMO or other) dominates the M-X(Y) bonding in these complexes: bonding and antibonding character is distributed among several of the valence orbitals. We propose a simple model to correlate the occupancy of antibonding M-X(Y) orbitals and rates of reductive elimination with the relative electronegativities of M and X(Y). The limitations of this model, and alternates to it, are described briefly. GRA

N81-21148# Max-Planck-Institut fuer Chemie, Mainz (West Germany). Abteilung Chemie der Atmosphere.

LABORATORY MEASUREMENTS OF PHOTOLYTIC PARAMETERS FOR FORMALDEHYDE Final Report

G. K. Moortgat, W. Klippel, K. H. Moebus, W. Seiler, and P. Warneck Nov. 1980 57 p refs

(Contract DOT-FA78WA-4264)

(AD-A096283; FAA/EE-80-47) Avail: NTIS HC A04/MF A01 CSCL 07/5

The photodecomposition of formaldehyde has been studied experimentally under simulated atmospheric conditions at temperatures 220 and 300 K. Quantum yields for H2 and CO formation are reported for the spectral region 270 - 355 nm and are used to derive quantum yields for the two primary photolytic pathways. Absorption cross sections are also reported for a number of different temperatures. The data have been used to calculate CH2O photodissociation coefficients in the atmosphere as a function of altitude. GRA

N81-21149# Battelle Columbus Labs., Ohio.

MECHANISMS OF PHOTOCHEMICAL DEGRADATION IN XANTHENE LASER DYES Final Report, 1 Apr. 1977 - 20 Dec. 1980

Robert E. Schwerzel and Nancy A. Edie 20 Feb. 1981 59 p refs

(Grant AF-AFOSR-3313-77; AF Proj. 2303)

(AD-A096411; AFOSR-81-0243TR) Avail: NTIS HC A04/MF A01 CSCL 07/5

The primary objective of this research program has been the detailed elucidation of the principal photochemical mechanisms which lead to the degradation of xanthene laser dyes. The research performed in the course of this program has led to the discovery of an unprecendent excited state pathway for the photodegradation of Kiton Red S, a sulforhodamine laser dye, in which the reactive, lowest energy excited triplet state of the molecule is populated by preferential intersystem crossing from upper singlet excited states, not from the singlet state nearest in energy to the triplet. The results obtained have also led to a tentative chronology of the first several stages in the photodegradation process, and have revealed the existence of a previously unknown contact charge transfer (CCT) complex between oxygen and methanol. While much remains to be learned about the details of the chemical reactions involved in the photodegradation of kiton Red S and other xanthene dyes under various conditions, the research performed during this program has achieved significant progress toward this goal. In particular, enough has been learned about the degradation of these dyes that it is now possible to suggest new strategies for slowing their degradation under lasing conditions. These include, in particular, the removal of excitation wavelengths below 240 nm by selective filtering, and the use of improved triplet quenchers. GRA

N81-21150# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

DEFLAGRATION-TO-DETONATION TRANSITION IN HETEROGENEOUS SOLIDS: A BIBLIOGRAPHY Final Report

E. W. Price Nov. 1980 67 p

(Contract N00014-77-C-0330)

(AD-A095829) Avail: NTIS HC A04/MF A01 CSCL 21/8

This publication contains a list of 341 references relating to the mechanism of transition to detonation in heterogeneous high energy solids, with particular reference to solid rocket propellants and granular propellant charges for guns. Because of the important role played by porosity, many of the references pertain to flow, flame spread and pressure rise in porous materials, and to the mechanics of formation cracks and propagation under dynamic loading. This partial list of references was developed primarily from lists contained in papers presented at the 1978 ONR/AFOSR Workshop on Deflagration-to-Detonation Transition (CPIA Publication 229, September 1978), and from reports received subsequent to that Workshop. A subject coding was developed and used to classify each reference. GRA

N81-21151# University of Southern California, Los Angeles. Dept. of Chemistry.

REACTION KINETICS OF THE INTERMEDIATE PRODUCED IN THE LASER PULSE PHOTOLYSIS OF TUNGSTEN HEXACARBONYL IN FLUID SOLUTION

Alistair J. Lees and Arthur W. Adamson 5 Mar. 1981 21 p refs Submitted for publication

(Contract N00014-76-C-0548)

(AD-A096186; TR-13) Avail: NTIS HC A02/MF A01 CSCL 07/5

Laser pulse photolysis at 353 nm of tungsten hexacarbonyl in room temperature methylcyclorexane produces an intermediate, proposed to be W(CO)5 S, S denoting solvent, with an absorption maximum at 425 nm and epsilon max. = 7,500 m to the -1 power cm. In the presence of added L = 4 acetylpyridine, the intermediate reacts completely to form W(CO)5 L as final product. The rate of disappearance of the intermediate is pseudo first order, with kapp linear in (L) at low concentration but approaching a limiting value at higher concentrations. The proposed mechanism is one of reversible dissociation of W(CO)5 S to W(CO)5 and S with rate constarts k sub 1 and k sub -1 followed by scavenging of the W(CO)5 by the L, with rate constant k sub 2. At 20 Ck sub 1 = 1,900,000 s to the -1 power and the corresponding

activation quantities and E sub 1 = 3.9 kcal mole and (*sub 1 - E sub 2* = 2.6 kcal mole. The nature of the primary photolysis step is discussed. GRA

N81-21152# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

FUNDAMENTAL COMBUSTION STUDIES OF EMULSIFIED FUELS Annual Progress Report, 1 Oct. 1979 - 30 Sep. 1980

I. M. Kennedy 1980 17 p

(Contracts ET-78-S-02-4920; DE-AC02-78ER-10113)

(DOE/ER-10113-8) Avail: NTIS HC A02/MF A01

Particular attention was given to understanding the phenomenon of micro-explosions and disruptive combustion. Earlier work which investigated the behavior of n-paraffin and water emulsions, binary mixtures of n-paraffins, and solutions of alcohol with n-paraffins was completed and is now published in the open literature. This work was extended to the study of the droplet combustion of a No. 2 fuel oil. Both emulsions with water and solutions of alcohols were investigated and very useful data were generated with regard to the optimization of the disruption phenomenon in terms of additive content. In addition, some preliminary work was done with micro-emulsions. This indicated the importance of further work to elucidate the role of surfactant loading. Theoretical work on the growth of gaseous bubbles in fuel droplets has helped to define some of the controlling parameters in the disruption phenomenon. Finally the design of a new free droplet apparatus was completed and an optical diagnostic technique for droplet sizing is near completion. DOE

N81-21153# State Univ. of New York, Buffalo. Dept. of Chemical Engineering.

HYDROGEN-METHANE SEPARATION PROCESSES AND RELATED PHENOMENA

J. T. Saunders, S. S. Wang, and R. T. Yang Jan. 1981 50 p refs

(Contract DE-AC21-80MC-14386)

(DOE/METC-14386/106) Avail: NTIS HC A03/MF A01

A literature survey on processes for separating hydrogen and methane is presented. This was done in conjunction with work developing a more energy efficient and lower cost process based on cyclic, fixed bed processes using coal chars as the sorbents. Although the review has covered all hydrocarbon separation processes, the focuses were on physical adsorption phenomena and theories (for both single and mixed gases), surface and pore characteristics of coals and heat-treated coals, and the continous or semi continuous chromatographic separation methods. Processes of hydrocarbon separation based on absorption/desorption competitive adsorption, the cyclic (including parametric pumping) processes, absorption on coal chars, and absorption on raw coals are investigated. J.D.H.

N81-21154# State Univ. of New York, Buffalo. School of Engineering and Applied Science.

CATALYTIC COMBUSTION OF SYNTHETIC FUELS Semiannual Report, 1 Aug. 1980 - 31 Jan. 1981

L. A. Kennedy and Eli Ruckenstein 1981 6 p

(Contract DE-FG22-80PC-30220)

(DOE/PC-30220/T1) Avail: NTIS HC A02/MF A01

The efforts on this project were directed towards three goals: (1) catalyst development: (2) preliminary measurements of fuel bound nitrogen conversion; and (3) design of a droplet injector and vaporization section for use with SRC-II liquids. An experimental apparatus was designed to examine NO conversion in a catalytic combustor. Argon-oxygen is the oxidizing gas. Minimizing conversion of fuel nitrogen to nitrogen oxides is the aim of this task. A multiport injector for coal derived liquid fuels is being designed. J.D.H.

N81-21155# Florida Univ., Gainesville. Dept. of Chemistry.

CATALYZED AIR ELECTRODES Final Report

H. A. Laitinen 1980 22 p refs

(Contract W-7405-eng-48)

(UCRL-15320) Avail: NTIS HC A02/MF A01

Several methods of platinization of tin oxide were compared. Two types of supporting materials, glass and silicon wafers lightly coated with SiO2, were used. Platinization was carried out by electrodeposition from aqueous solution, electrodeposition from platinum (2) acetylacetonate in nonaqueous solution, thermal decomposition of platinumm (2) acetylacetonate, and chemisorption from aqueous solution followed by thermal decomposition. The electrodeposition methods and thermal decomposition all yielded platinum crystallites, but the chemisorption method gave dispersions approach unity. All preparations showed catalytic activity for the electroreduction of oxygen, but the most efficient from the view point of economy of platinum utilization was the chemisorption method. Stability tests indicated that preparations containing less than monolayer equivalent amounts of platinum were exceptionally stable to 5M KOH at 500. Under more severe conditions (9M KOH at 900) the SnO2 layer was etched and Pt loss occurred under open circuit conditions. DOE

N81-21156# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

BUBBLE DYNAMICS AT GAS-EVOLVING ELECTRODES Ph.D. Thesis

Paul J. Sides Dec. 1980 159 p refs

(Contract W-7405-eng-48)

(LBL-11849) Avail: NTIS HC A08/MF A01

Oxygen was evolved on a transparent tin oxide window electrode and the events were viewed from the backside. Movies showed that coalescence of bubbles determines the size of bubbles and the chain of transport processes; growth by diffusion and by coalescence proceeds in series and parallel; coalescing bubbles cause significant fluid motion close to the electrode; bubbles can leave and reattach; and bubbles evolve in a cycle of growth by diffusion and different modes of coalescence. An analytical solution for the primary potential and current distribution around a spherical bubble in contact with a plane electrode is presented. Zero at the contact point, the current density reaches only 1 percent of its undisturbed value at 30 percent of the radius from that point and goes through a shallow maximum two radii away. The solution for spherical bubbles applies for the small bubbles of electrolytic processes. A densely populated gas bubble layer on an electrode was modeled as a hexagonal array of dielectric spheres. As lucite spheres were placed in one end of a hexagonal cell, the resistance as a function of gas bubble layer packing density sharply increased as close packing was approached. DOE

N81-21157# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

MODELING OF CHANGING ELECTRODE PROFILES Ph.D. Thesis

Geoffrey Allan Prentice Dec. 1980 233 p refs

(Contract W-7405-eng-48)

(LBL-11694) Avail: NTIS HC A11/MF A01

A model for simulating the transient behavior of solid electrodes undergoing deposition or dissolution was developed. The model accounts for ohmic drop, charge transfer overpotential, and mass transport limitations. The finite difference method coupled with successive overrelaxation was used as the basis of the solution technique. An algorithm was devised to overcome the computational instabilities associated with the calculations of the secondary and tertiary current distributions. Simulations were performed on several model electrode profiles: the sinusoid, the rounded corner, and the notch. Quantitative copper deposition data were obtained in a contoured rotating cylinder system. Sinusoidal cross sections machined on stainless steel cylinders were used as model geometries. Kinetic parameters for use in the simulation were determined from polarization curves obtained on copper rotating cylinders. These parameters, along with other physical property and geometric data, were incorporated in simulations of growing sinusoidal profiles. DOE

N81-21158# California Univ., Livermore. Lawrence Livermore Lab.

ELECTROLYTES: TRANSPORT PROPERTIES AND NON-EQUILIBRIUM THERMODYNAMICS

D. G. Miller Dec. 1980 27 p refs Presented at the 2d Australian Thermodyn. Conf., Melbourne, 15-19 Feb. 1981 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-85232; CONF-810210-1) Avail: NTIS HC A03/MF A01

The application of nonequilibrium thermodynamics to transport

in electrolyte solutions is presented. Recent experimental work and results for mutual diffusion in electrolyte solutions are discussed. DOE

N81-21159# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Materials Science and Mineral Engineering.
CAVITATIONAL EFFECTS DURING CREEP IN POLYCRYSTALLINE ALUMINA M. S. Thesis
William Richard Blumenthal Nov. 1980 56 p refs
(Contract W-7405-eng-48)
(LBL-11830) Avail: NTIS HC A04/MF A01

Cavitation in deformed fine grained Al2O3 was studied as a function of deformation temperature and strain rate. Three distinct cavity profiles were observed in varying proportions depending on the temperature and loading rate. Symmetrically shaped equilibrium cavities were observed at low stress and temperature. Crack-like (nonequilibrium) cavities were observed at higher stress and temperature. Full facet cavities were observed as the end product of crack-like cavity growth and as a precursor to coalescence. These observations provide strong support for the cavity growth model developed by Chuang, et al. and establish cavitation as an important deformation and failure mechanism in ceramic materials. DOE

N81-21160# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
AUGER ELECTRON SPECTROSCOPY
G. A. Somorjai Dec. 1980 45 p refs Presented at the EXXON Conf. on Surface Sci., Linden, N.J., 4-5 Dec. 1980
(Contract W-7405-eng-48)
(LBL-11720; CONF-801238-1) Avail: NTIS HC A03/MF A01

A review of Auger electron spectroscopy is presented. Methods, resolution, sensitivity, and uses are discussed. DOE

N81-21161# Argonne National Lab., Ill. Energy and Environmental Systems Div.
ENERGY AND MATERIALS FLOWS IN THE PRODUCTION OF OLEFINS AND THEIR DERIVATIVES
L. L. Gaines and S. Y. Shen Aug. 1980 184 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-9) Avail: NTIS HC A09/MF A01

Production of olefins and their derivatives uses almost 3.5% of the oil and gas consumed annually in the United States. It is estimated that their production requires an input energy of 2 Q, which is 50% of the energy used in the production of all petrochemicals. Substantial amounts of this energy could be recovered through recycling. For example, recycling of a single plastic product, polyester soft drink bottles, could have recovered about 0.014 Q in 1979. Petrochemical processes use fuels as feedstocks, as well as for process energy, and a portion of this energy is not foregone and can be recovered through combustion of the products. The energy foregone in the production of ethylene is estimated to be 7800 Btu/lb. The energy foregone in plastics production ranges from 12,100 Btu/lb for the linear low density polyethylene to 77,200 Btu/lb for nylon 66, which is about 60% of the total energy input for that product. DOE

N81-21162# European Space Agency, Paris (France).
EVALUATION OF THYROID HORMONES BY GAS CHROMATOGRAPHY
Wolfgang Raabe Oct. 1980 21 p refs Transl. into ENGLISH of 'Die gaschromatographische Bestimmung von Schilddruesenhormonen', DFVLR, Bonn Report DFVLR-FB-79-07, Jan. 1979 Original report in GERMAN previously announced as N80-22975
(ESA-TT-620; DFVLR-FB-79-07) Avail: NTIS HC A02/MF A01

The thyroid hormones were studied with various analytical columns. A method is proposed for the assay of human serum in which the use of a vacuum system would allow the detection limit to be improved by three orders of magnitude. The development of apparatus for vacuum chromatography should make it possible to determine the composition and changes in brain metabolism during simulated space travel conditions, particularly the amino acids and neurotransmitters which have major physiological significance. A.R.H.

N81-21163# Municipal Environmental Research Lab., Cincinnati, Ohio. Technology Development Support Branch.
GC/MS METHODOLOGY FOR PRIORITY ORGANICS IN MUNICIPAL WATERWASTE TREATMENT Final Report
Dolloff F. Bishop Nov. 1980 52 p refs
(PB81-127813; EPA-600/2-80-196) Avail: NTIS HC A04/MF A01 CSCL 07D

The current GC/MS methodology for the analysis of priority toxic organics in municipal wastewater treatment is reviewed. A methodology was developed for the measurement of priority toxic organics based on GC/MS technology. Municipal wastewaters and sludges contain a wide variety of extractable organics which can interfere in the GC/MS analysis. The extracts may require clean-up or organics separation before the GC/MS analyses. Principal classes of organic interferences include lipids, fatty acids and saturated hydrocarbons. The approaches to separate the desirable priority organics from the interferences include acid/base separation, molecular size separation and polarity separation. GRA

N81-21164# SRI International Corp., Menlo Park, Calif. Engineering Sciences Lab.
THE INFLUENCE OF ACCELERATION AND FLOW ON CONCENTRATION POLARIZATION IN REVERSE OSMOSIS Final Report
Gerry B. Andeen and Manchi S. Colah Nov. 1980 179 p refs
(Contract DI-14-34-0001-9462; SRI Proj. 1005)
(PB81-134926; W81-00971; OWRT-C-80364-S(9462)(1))
Avail: NTIS HC A09/MF A01 CSCL 07D

Hollow-fiber reverse osmosis elements were operated in a continuous flow centrifuge up to 1000 g. Increased flow and quality of desalted water indicated reduced concentration polarization under acceleration or increased brine flow. The effective mass transfer coefficient for removal of salt from the membrane surface was changed as much by doubling the acceleration as by doubling the flushing flow. Use of acceleration would allow use of higher transport rate membranes. This, together with fouling reduction, may make use of centrifuges in reverse osmosis economically attractive. GRA

N81-21165# Southwest Research Inst., San Antonio, Tex.
ANALYTICAL PROCEDURES FOR CHARACTERIZING UNREGULATED EMISSIONS FROM VEHICLES USING MIDDLE-DISTILLATE FUELS Interim Report
Lawrence R. Smith, Mary E. Parness, E. Robert Fanick, and Harry E. Dietzmann Apr. 1980 507 p refs
(Contract EPA-68-02-2497)
(PB81-136186; EPA-600/2-80-068) Avail: NTIS HC A22/MF A01 CSCL 07D

Methods of collection and analysis for aldehydes and ketones, for hydrogen cyanide, and cyanogen, for hydrogen sulfide, carbonyl sulfide and organic sulfides, for ammonia and amines, for nitrous oxide, sulfur dioxide, individual hydrocarbons, for soluble sulfate and N nitrosodimethylamine, benzo-a-pyrene, and phenols were studied in detail. Ten analytical procedures were developed and codified. Interference studies and proof tests in diesel engine exhaust were conducted with every procedure and the results of these experiments are reported in detail. GRA

N81-21166# Permutit Co., Inc., Princeton, N. J. Research and Development Center.
PILOT PLANT STUDY ON MARINE MICROORGANISMS AND ORGANIC MATTER IN SEAWATER DESALINATION BY RO (REVERSE OSMOSIS)
A. B. Mindler and S. T. Bateman 12 May 1980 138 p refs
(Contract DI-14-34-0001-8538)
(PB81-131468; W81-00639; OWRT-C-80316-S(8538)(1))
Avail: NTIS HC A07/MF A01 CSCL 07D

A seawater desalination pilot plant was operated for one year under tropical conditions with emphasis on biological aspects. Pretreatment consisted of chlorination, in-line coagulation with iron sulfate, filtration, dechlorination with excess sodium bisulfite, and alkaline scale prevention by two methods operated in parallel. ON-stream time was about 50 percent. The productivity of the 4 inch hollow fiber permeator on pH adjusted feed decreased to 765 gpd (74 percent of projected productivity) in 2700 hours, and to 850 gpd (87 percent of projected productivity) in

4460 hours on the permeator on antiscalant feed. Rejections were in excess of 98.9 and 99.1 percent, respectively at 30 percent recovery. GRA

N81-21167# Colorado Univ., Denver. Dept. of Chemistry.
THE EFFECTS OF OZONATION OF ORGANICS IN WASTEWATER Progress Report, 1 May 1976 - 30 Apr. 1979
Willard R. Chappell, Robert E. Sievers, and Robert H. Shapiro Jan. 1981 148 p refs
(Grant EPA-R-804472)
(PB81-135360; EPA-600/1-81-005) Avail: NTIS HC A07/MF A01 CSCL 07D

Organic constituents were identified in wastewater that was treated with ozone. The primary products of ozonation of this wastewater are n-alkanes and n-aldehydes. Additional wastewater from this and n-aldehydes. Additional wastewater from this and other sources, including paper mills and chemical effect of ozone treatment. GRA

N81-21168# Membrane Systems, Inc., San Diego, Calif.
DEVELOPMENT OF CHLORINE RESISTANT MEMBRANE, ASYMMETRIC POLYIMIDE MEMBRANE AND POROUS SUBSTRATES Final Report
Richard G. Sudak, John M. Chirrick, Ronald L. Fox, Max E. McKee, James B. Bott, and John E. Tomaschke Sep. 1980 244 p
(Contract DI-14-34-0001-9515)
(PB81-142242; W81-00681; OWRT-C-90176-D(9515)(1)) Avail: NTIS HC A11/MF A01 CSCL 07D

The development of chlorine resistant membrane, asymmetric polyimide membrane, and porous substrates was studied. The development of supports with different polymeric materials was undertaken to increase: (1) the number of possible solvents for use in membrane barrier layer formation, and (2) the allowable temperature for such formation. The materials were developed with pore size variations for use in ultrafiltration/microfiltration applications as well as hyperfiltration. It was found that cellulose acetate is stable to low residual chlorine concentrations in feedwaters, but polymide in sheet composite membrane or asymmetric hollow fine fibers was not. The mechanism of residual chlorine degradation of various polymers which caused synthesis of several polymers and their subsequent reaction to form polyimide membrane layers was also investigated. E.A.K.

N81-21169# Gulf South Research Inst., New Orleans, La.
DEVELOPMENT OF NOVEL POROUS SUBSTRATES FOR ULTRAFILTRATION, DESALINATION AND WATER RECLAMATION Final Report
Israel Cabasso 31 Jan. 1980 105 p refs
(Contract DI-14-34-0001-8521)
(PB81-147787; W81-01001; OWRT-C-80294-S(8521)(1)) Avail: NTIS HC A06/MF A01 CSCL 07D

Poly(phenylen oxide) (PPO) polymers were successfully cast into an anisotropic porous substrate for utilization in water reclamation. E-amino naphtalene sultonic acid was applied from aqueous solution to chemically interact and produce an ionic, charged surface. Low molecular weight organoionic solutes can be efficiently removed in a low pressure ultrafiltration process. The substrate displays a crystalline coral morphology which has the endurance required from the support component of a reverse osmosis membrane. This combined with the superb chemical stability of the membrane, allows deposition of a permaselective, ultrathin membrane from solvent systems which would dissolve a conventional polysulfone support. Cellulose acetate and cellulose triacetate were deposited on a MPPO support from etone/dioxane solution. GRA

N81-21170# Biphase Energy Systems, Inc., Santa Monica, Calif.
DESALINATION/POWER CYCLES WITH THE BIPHASE ROTARY SEPARATOR AND TURBINE Final Report
Paul L. Limburg Sep. 1980 93 p refs
(Contract DI-14-34-0001-9407)
(PB81-150237; W81-01165; OWRT-C-90028-D(9407)(1)) Avail: NTIS HC A05/MF A01 CSCL 07D

The biphase rotary separator turbine (RST) generates fresh water and power when using salt water as a working fluid. Cycle studies of single and two stage RST cycles determined water production rates to be 0.6 to 1.8 pounds per thousand Btus of heat input and net power-production efficiencies of 2 to 10 percent, depending on cycle configuration and the maximum saltwater temperature. The biphase RST can be beneficially integrated with conventional desalination processes. Cycles studied include a topping cycle for distillation plants, shaft-power-source cycle for reverse osmosis, and vapor-compression plants, and a reverse-osmosis cycle recovering the reject-brine pressure energy. Short duration tests of a biphase RST showed that fresh water production from seawater is feasible. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-21171*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONSIDERATIONS ON REPEATED REPAIRING OF WELDMENTS IN INCONEL 718 ALLOY
E. O. Bayless, C. V. Lovoy, M. C. McIlwain, and P. Munafo Mar. 1981 37 p refs
(NASA-TM-82409) Avail: NTIS HC A03/MF A01 CSCL 11F

The effects of repeated weld repairs on the metallurgical characteristics, high cycle fatigue (HCF), and tensile properties of Inconel 718 butt weld joints were determined. A 1/4 in thick plate and a 1/2 in thick plate were used as well as tungsten inert gas welding, and Inconel 718 filler wire. Weld panels were subjected to 2, 6, and 12 repeated repairs and were made in a highly restrained condition. Post weld heat treatments were also conducted with the welded panel in the highly restrained condition. Results indicate that no significant metallurgical anomaly is evident as a result of up to twelve repeated weld repairs. No degradation in fatigue life is noted for up to twelve repeated repairs. Tensile results from specimens which contained up to twelve repeated weld repairs revealed no significant degradation in UTS and YS. However, a significant decrease in elongation is evident with specimens (solution treated and age hardened after welding) which contained twelve repeated repairs. The elongation loss is attributed to the presence of a severe notch on each side (fusion line) of the repair weld bead reinforcement. R.C.T.

N81-21172*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WELD GEOMETRY STRENGTH EFFECT IN 2219-T87 ALUMINUM
A. C. Nunes, Jr., H. L. Novak, and M. C. McIlwain Mar. 1981 47 p refs
(NASA-TM-82404) Avail: NTIS HC A03/MF A01 CSCL 11F

A theory of the effect of geometry on the mechanical properties of a butt weld joint is worked out based upon the soft interlayer weld model. Tensile tests of 45 TIG butt welds and 6 EB beads-on-plate in 1/4-in. 2219-T87 aluminum plate made under a wide range of heat sink and power input conditions are analyzed using this theory. The analysis indicates that purely geometrical effects dominate in determining variations in weld joint strength with heat sink and power input. Variations in weld dimensions with cooling rate are significant as well as with power input. Weld size is suggested as a better indicator of the condition of a weld joint than energy input. Author

N81-21173*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPUTTERED PROTECTIVE COATINGS FOR DIE CASTING DIES
Michael J. Mirtich, Cuo-Yo Nieh (Case Western Reserve Univ.), and John F. Wallace (Case Western Reserve Univ.) 1981 14 p refs Presented at the 1981 Intern. Conf. on Met. Coatings, San Francisco, 6 - 10 Apr. 1981
(NASA-TM-81735; E-803) Avail: NTIS HC A02/MF A01 CSCL 11F

This investigation determined whether selected ion beam sputtered coatings on H-13 die steel would have the potential of improving the thermal fatigue behavior of the steel used as a die in aluminum die casting. The coatings were selected to test

candidate insulators and metals capable of providing protection of the die surface. The studies indicate that 1 micrometer thick W and Pt coatings reduced the thermal fatigue more than any other coating tested and are candidates to be used on a die surface to increase die life. E.D.K.

N81-21174*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ION BEAM SPUTTER ETCHING OF ORTHOPEDIC IMPLANTED ALLOY MP35N AND RESULTING EFFECTS ON FATIGUE

Edwin G. Wintucky, Mark Christopher, Eugene Bahnuik, and Simon Wang Mar. 1981 35 p refs Presented at 15th Intern. Electric Propulsion Conf., Las Vegas, 21-23 Apr. 1981; sponsored by AIAA, Japan Soc. for Aeron. and Space Sci. and DGLR

(NASA-TM-81747; E-782) Avail: NTIS HC A03/MF A01 CSCL 11F

The effects of two types of argon ion sputter etched surface structures on the tensile stress fatigue properties of orthopedic implant alloy MP35N were investigated. One surface structure was a natural texture resulting from direct bombardment by 1 keV argon ions. The other structure was a pattern of square holes milled into the surface by a 1 keV argon ion beam through a Ni screen mask. The etched surfaces were subjected to tensile stress only in fatigue tests designed to simulate the cyclic load conditions experienced by the stems of artificial hip joint implants. Both types of sputter etched surface structures were found to reduce the fatigue strength below that of smooth surface MP35N. Author

N81-21175# Payne, Inc., Los Altos, Calif.

DEMONSTRATION OF THE INTEGRITY OF TUNGSTEN LINED LAUNCH TUBES FOR USE ON A HYBRID LAUNCHER Final Report, 3 Dec. 1979 - 31 Jul. 1980

Thomas J. Dahm 31 Jul. 1980 46 p refs

(Contract DNA001-80-C-0088)

(AD-A096316; FR-270; DNA-5420F) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report summarizes developments to date concerning tungsten thermal protection for application to a hybrid hypervelocity launcher. Two complete tungsten coating processes are developed to provide good bonding of the coating and appropriate mechanical properties of the substrate. Three launch tubes were fabricated for exposure to severe internal ballistic environments. Internal ballistic exposures were provided to two of the tubes in three successive firings using 1/8 scale injection hardware developed under the hybrid launcher program. Modifications to the explosive driver designs are shown to provide very simple refurbishment of the launcher injection block between tests. Details are presented concerning driver and internal ballistic performance, instrumentation for the 1/4 scale demonstrator, and tungsten coating characteristics. A medium temperature tungsten coating process is demonstrated to provide high quality tungsten liners that are well bonded to a steel substrate having appropriate mechanical properties, and that survive severe internal ballistic environments. GRA

N81-21176# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.

HYDROGEN ABSORPTION DURING ELECTRODEPOSITION AND HYDROGEN CHARGING OF Sn AND Cd COATINGS ON IRON Technical Progress Report

M. Zamanzadeh, A. Allam (Cairo Univ., Egypt), C. Kato (Cairo Univ., Egypt), B. Ateya, and H. W. Pickering 4 Feb. 1981 33 p refs

(Contract N00014-75-C-0264)

(AD-A096309; TR-16) Avail: NTIS HC A03/MF A01 CSCL 13/8

A study was made of the extent of hydrogen absorption during electrodeposition of Sn or Cd onto an Fe Substrate, and, subsequently during electrolytic hydrogen charging of the Sn or Cd-coated Fe membranes. The effectiveness of deposits, in general, for decreasing hydrogen absorption by the substrate is discussed in terms of their barrier character and of their catalytic nature for promoting the hydrogen evolution reaction. The latter is a new method for decreasing hydrogen absorption. The reduction in hydrogen absorption was found to be in proportion to the coating thickness at approx. = 1 micrometer. Analysis of the data indicates that diffusion of hydrogen through the coating is the rate determining step of the permeation process, and that the product of the diffusivity and solubility of hydrogen is in the following order: Sn - Cd - Fe. The effective diffusivity of hydrogen at 25 C in both the Sn and Cd electrodeposits approx. - 10 to the 10th power/sq cm/s. These diffusivities could be obtained in relatively short time experiments since the coatings were quite thin. As such the bilayer membrane offers advantages over the usual single layer membrane for obtaining the diffusivity of hydrogen in metals for which the permeability is very low. GRA

N81-21177# Naval Weapons Support Center, Crane, Ind. Applied Sciences Dept.

EXOTHERMIC IR SOURCE MATERIALS LITHIUM-BORON ALLOY MATERIALS Progress Report, 1 Oct. 1979 - 30 Sep. 1980

Harlan L. Lewis 1 Oct. 1980 19 p refs

(WR02402002)

(AD-A096226; NWSC/CR/RDTR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

The preparation of a lithium-boron compound alloy is discussed. Its reactivity with an ambient atmosphere, and with dry and humid atmospheres of air, oxygen, and nitrogen is presented and compared to the reactivity of lithium metal under similar conditions. GRA

N81-21178# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

CRACK ARRESTMENT COMPOUNDS OF CORROSION FATIGUE FOR HIGH STRENGTH 4340 STEEL Progress Report

V. S. Agarwala and J. J. DeLuccia 14 Jan. 1981 19 p refs

(ZR0000101; ZR02208)

(AD-A095884; NADC-80229-60) Avail: NTIS HC A02/MF A01 CSCL 11/6

It has been shown that the fatigue life of a high strength Type 4340 steel exposed to high humidity is reduced by an order of magnitude when compared to dry ambient air. This has been directly attributed to the effects of corrosion and hydrogen embrittlement. In the present work, the principles of process control, which affect the electrochemical reactions occurring at the tip of the advancing crack, are integrated with the metallurgical concepts of the stress cracking phenomena to develop new crack arrestment compounds. The concept of phase transfer catalysis has been used to solubilize inorganic inhibitors into an organic phase. This enabled the inhibitor ions to remain free of hydration shell s and become more effective inhibitors. It has been demonstrated that a number of combinations of compounds such as those containing chromate, borate and nitrite, or nitrite, borate and cerate have been successful in retarding the fatigue crack growth rate of Type 4340 steel exposed to 90% relative humidity. Author (GRA)

N81-21179# Oak Ridge National Lab., Tenn.

STRESS CORROSION STUDIES IN SOLVENT REFINED COAL LIQUEFACTION PILOT PLANTS

V. B. Baylor, J. R. Keiser, M. D. Allen, and E. J. Lawrence Dec. 1980 48 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7513) Avail: NTIS HC A03/MF A01

The causes of stress corrosion cracking in solvent refined coal (SRC) reactor materials are examined. To screen candidate materials of construction for resistance to stress corrosion cracking, racks of stressed U bend specimens in welded and as wrought conditions were exposed at the Wilsonville and Fort Lewis SRC pilot plants. Alloys that are suitable for critical plant applications were identified. DOE

N81-21180# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.

OXYGEN DIFFUSION IN VANADIUM-BASED ALLOYS Ph.D. Thesis

Roberto Ribeiro DeAvillez 1981 114 p refs

(Contracts DE-AC02-76ER-01198; EY-76-C-02-1198)

(DOE/ER-01198-1338) Avail: NTIS HC A06/MF A01

The experimental study of transport and equilibrium properties of oxygen in vanadium based alloys was made by EMF measurements on solid electrolytic cells over the temperature

range of 873 to 14230 K. The oxygen diffusion in vanadium was not significantly modified by small additions of Ti, Cr, Ni, Nb, and Ta. The increase in the activation energy for oxygen diffusion in the V based alloys containing Cr, Ni, Nb, and Ta probably reflects the effects of these substitutional solutes on the activity coefficient of oxygen. The oxygen activity was increased by the addition of 1 at% of Cr, Ni and Nb, and decreased by the addition of Ti and Ta. However, the effects in the alloys containing Nb and Ta are very small. DOE

N81-21181# Climax Molybdenum Co. of Michigan, Ann Arbor.
METALLOGRAPHIC STUDY OF TYPE 304 STAINLESS STEEL: LONG-TERM CREEP-RUPTURE SPECIMEN
V. A. Biss and V. K. Sikka (ORNL) Jan. 1981 14 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7618) Avail: NTIS HC A02/MF A01

Microstructural analyses were performed on a type of 304 stainless steel creep-rupture specimen that exhibited a 59,900 h rupture life at 5950 C and 117 MPa. The long term creep-rupture exposure was accompanied by precipitation of CR23C6 in the matrix and along the grain boundaries and iron chromium type sigma phase along the grain boundaries. Stress induced local grain boundary migration was evident and was associated with simultaneous dissolution of carbide particles and formation of sigma phase along the migrating boundary. In small isolated locations, austenite transformed to ferrite. DOE

N81-21182# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECTS OF OXIDATION ON THE IMPACT ENERGY OF HASTELLOY S AND HASTELLOY C-4 CHARPY V-NOTCH SPECIMENS HEATED IN AIR TO 600 TO 800 DEG C
H. T. Fullam Jan. 1981 37 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3641) Avail: NTIS HC A03/MF A01

Oxidation tests therefore carried out at 6000 to 8000 C for exposures up to 10,000h to cover the range of temperature the outer capsule of a SrF2 heat source might expect to encounter in service. The results show that the oxidation of Hastelloy S and Hastelloy C-4 in air at 6000 to 8000 C is very slow, and both alloys form adherent oxide layers that serve to protect the underlying metal. Subsurface attack of Hastelloy S and Hastelloy C-4 due to oxidation was greater than expected, considering the slow oxidation rates of the two alloys at 6000 to 8000 C. Estimates of subsurface attack, determined from micrographs of the oxidized specimens, showed erratic results and it was impossible to assign any type of rate equation to the subsurface attack. A conservative estimate of long term effects can be made using a linear extrapolation of the test results. There were no significant differences between the room temperature Charpy impact energy of Hastelloy S and Hastelloy C-4 specimens oxidized in air at 6000 to 8000 C and control specimens heated in vacuum. DOE

N81-21183# Westinghouse Research and Development Center, Pittsburgh, Pa.
STUDY TO OPTIMIZE Cr-Mo STEELS TO RESIST HYDROGEN AND TEMPER EMBRITTLEMENT. EMBRITTLEMENT OF Cr-Mo STEELS IN H2S PLUS H2O VAPOR ENVIRONMENT Quarterly Report, 15 May - 15 Aug. 1980
B. J. Shaw 28 Nov. 1980 20 p refs
(Contract DE-AC05-78RET-13513)
(DOE/ET-13513-T6; QR-8) Avail: NTIS HC A02/MF A01

The H2S + H2O vapor environment tests yield data which is within the normal experimental scatter and differentiates between the hydrogen resistance of candidate steel samples. A potential problem stemming from the deep side grooves, which promote advanced crack growth in the higher strength steels, is overcome by reducing the side grooves to 25 percent. DOE

N81-21184# Illinois Univ., Urbana. Minerals Research Lab.
QUADRUPOLE INTERACTIONS IN MOLYBDENUM BASE DILUTE BINARY VANADIUM AND NIOBIUM ALLOYS M.S. Thesis
Lih-Hsin Chou 1981 47 p refs
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198-1337) Avail: NTIS HC A03/MF A01

The (95)Mo resonance in pure Mo after filing and annealing near 10000 C consists entirely of the m = 1/2 (FEMALE) -1/2 transition. Decreased absorption intensity and line broadening caused by solute addition can be understood as a direct result of second order perturbation of the m = 1/2 (FEMALE) -1/2 transition. A/h for (95)Mo is roughly 200 Hz for nuclei near either V or Nb in Mo. The data establish the magnitude and the mechanism of the broadening observed in (95)Mo when V and Nb are present as minor alloying elements (0 to 10 at. percent). DOE

N81-21185# Princeton Univ., N. J. Plasma Physics Lab.
CO ABSORPTION ON Al-Zr AT ROOM TEMPERATURE
C. H. Wu, R. L. Moore, and S. A. Cohen Oct. 1980 19 p refs
(Contract DE-AC02-76CH-03073)
(PPPL-1721) Avail: NTIS HC A02/MF A01

A study of CO adsorption on room temperature Al-Zr was done using Auger electron spectroscopy and gas pressure measurements. The atomic surface composition of clean Al-Zr surfaces prepared in UHV by Ar(+) sputtering was measured as a function of CO pressure and exposure time. The adsorbed C and O have the same rate constants and surface concentrations for exposures less than 2 Langmuir. Above this exposure quasisaturation occurs. The effect of surface roughness on the apparent sticking coefficient was calculated by a Monte Carlo simulation. Reactivation of Al-Zr by heat treatment to 700 C was also studied. DOE

N81-21186# Princeton Univ., N. J. Plasma Physics Lab.
STUDY OF THE KINETICS OF THE INTERACTIONS OF CARBON MONOXIDE AND OXYGEN WITH Al-Zr SURFACE
C. H. Wu Nov. 1980 24 p refs
(Contract DE-AC02-76CH-03073)
(PPPL-1725) Avail: NTIS HC A02/MF A01

The interaction of CO and O2 with clean Al-Zr (40/60 atomic percent) surfaces were studied with Auger electron spectroscopy. The initial sticking probability of O2 on Al-Zr was measured to be S/sub 0, O2/ = 0.85. The sticking probabilities of O2 and CO as a function of CO and O2 contamination on a Al-Zr surface were determined. It is found that CO adsorption is sensitive to O2 contamination. The CO contamination is not effective at blocking the surface to subsequent O2 adsorption. DOE

N81-21187# Chicago Univ., Ill. Dept. of Chemistry.
SYNTHESIS, CHEMISTRY AND CATALYTIC ACTIVITY OF COMPLEXES OF LANTHANIDE AND ACTINIDE METALS IN UNUSUAL OXIDATION STATES AND COORDINATION ENVIRONMENTS Progress Report, 1 Feb. 1980 - 31 Jan. 1981
William J. Evans Oct. 1980 10 p refs
(Contract DE-AS02-77ER-04216)
(COO-4216-8) Avail: NTIS HC A02/MF A01

Investigations were conducted on two classes of lanthanide compounds: metal vapor co-condensation reactions with unsaturated hydrocarbons and homoleptic and heteroleptic alkyl lanthanide complexes. Three models were considered for the interaction or erbium atoms with 3-hexyne. The structure of the heteroleptic alkynide [(C5H5)2ErC triple bond CCMe3]2 was studied. Some organolanthanides were prepared. DOE

N81-21188# National Physical Lab., Teddington (England). Div. of Materials Applications.
THE EFFECT OF AUSTENITIZING TREATMENTS ON THE MICROSTRUCTURE AND CREEP PROPERTIES OF COMMERCIAL AND HIGH PURITY 1/2Cr-1/2Mo-1/4V STEELS
R. K. Varma and H. R. Tipler Aug. 1980 33 p refs
(NPL-DMA(A)-13; ISSN-0143-7313) Avail: NTIS HC A03/MF A01

Techniques used to produce specimens with specific creep properties from two types of 1/2 Cr 1/2 Mo 1/4 V steel, i.e., high purity and commercial purity, having different hardening and grain growth characteristics are described. The production of steels with identical microstructures was desired to provide material for an investigation of the effect of complex stresses in creep. Material for samples was produced by hot rolling at 1050 C. In general the high purity steel has better hardening characteristics and is also more prone to grain growth. Consequently, it was necessary to investigate the effects of various

austenitizing conditions and of different rates of cooling on the microstructures obtained. The results of uniaxial creep tests are consistent with those previously obtained on similar steels.
Author (ESA)

N81-21189# Battelle Inst., Frankfurt am Main (West Germany).
***ON THE FORMATION AND COAGULATION OF CLUSTERS* DURING THE SOLIDIFICATION OF INMISCIBLE ALLOYS**
Final Report
Dieter Langbein Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 96 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-25; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

The numerous physical effects which contribute to segregation during the solidification of immiscible alloys under microgravity conditions are analyzed. Particular attention is given to the decrease in the temperature profile, the formation and growth of droplets, and the interrelations between the phase diagram, the enthalpy of mixing, and the interface enthalpy. Convection, attraction and coagulation of droplets as well as the migration of droplets in front of the interface of solidification are also considered. Results indicate that the largest contribution to the attraction between forming droplets is caused by the overlap of the regions with lowered concentration surrounding them. Minimization of the interfacial energy may cause coagulation within a few millisec. Therefore, coagulation can be avoided only if the lowering in concentration surrounding the droplets or the interfacial energy are very small. These conditions contradict the assumed immiscibility of the alloys under consideration, i.e., Al(x) In(1-x), Al(x) Pb(1-x), and Zn(x) Pb(1-x). Author (ESA)

N81-21190# Karlsruhe Univ. (West Germany). Inst. fuer Chemische Technik.
***OXIDATION AND HOT CORROSION RESISTANT* REFRACTORY MATERIAL FOR THE 1000 TO 1600 C TEMPERATURE RANGE [OXIDATIONS- UND HEISSKORROSIONSBESTAENDIGER HOCHTEMPERATURWERKSTOFF FUER TEMPERATUREN VON 1000-1600 C**
Juergen Schlichting Bonn Bundesminister der Verteidigung 1979 89 p refs In GERMAN; ENGLISH summary Sponsored by Bundesminister der Verteidigung
(BMVg-FBWT-79-32) Avail: NTIS HC A05/MF A01

A metallic refractory material resistant to oxidation in air and to hot corrosion in combustion gases (with NaCl, V2O5 and H2S additions) is described. It is made from niobium, tantalum or alloys of these metals and is coated with a sintered 200 to 300 micron thick protective layer of MoSi2. Tests confirms the suitability of this material for turbine blade applications. Damage was not observed in preliminary tests carried out with centrifugal accelerations of 100,000 g at 1200 C. Author (ESA)

N81-21191# Terra Tek, Inc., Salt Lake City, Utah.
SHORT ROD AND SHORT BAR FRACTURE TOUGHNESS *SPECIMEN GEOMETRIES AND TEST METHODS FOR METALLIC MATERIALS*
L. M. Barker Mar. 1980 42 p refs
(Grant NSF DAR-78-20993)
(PB81-140121; TR-80-11; NSF/RA-800321) Avail: NTIS HC A03/MF A01 CSCL 11F

The use of short rod and short bar fracture toughness specimens to measure the plane terrain critical stress intensity factor of metallic materials is examined. Short rod and short bar specimen design considerations are discussed, and various specimen geometries with essentially equivalent test behavior and calibrations are presented. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-21192*# IIT Research Inst., Chicago, Ill.
SPACE PROCESSING OF CHALCOGENIDE GLASS *Final Report, 7 Mar. 1977 - 30 Sep. 1978*
R. F. Firestone and S. W. Schramm 31 Oct. 1978 40 p
(Contract NAS8-32388)
(NASA-CR-161702; Rept-D-6137) Avail: NTIS HC A03/MF A01 CSCL 11B

A program was conducted to develop the technique of space processing for chalcogenide glass, and to define the process and equipment necessary. In the course of this program, successful long term levitation of objects in a 1-g environment was achieved. Glass beads 4 mm diameter were containerless melted and fused together. S.F.

N81-21193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE BOUNDARY LUBRICATION WITH FORMULATED C-ETHERS TO 260 C
William R. Loomis Apr. 1981 16 p refs
(NASA-TP-1812; E-480) Avail: NTIS HC A02/MF A01 CSCL 07C

Steady state wear and friction studies were made at boundary lubrication conditions in a pin on disk (pure iron on rotating CVM M 50 steel) sliding friction apparatus with five C ether formulated fluids (modified polyphenyl ether containing phosphrous ester, organic acid, and other additives). Conditions included 20, 150, and 260 C disk temperatures, dry air test atmosphere, 1 kilogram load, 50 rpm disk speed, and test times to 130 minutes. Results were compared with those obtained with a formulated MIL L 27502 candidate ester and the C ether base fluid. Three of the C ether formulations gave better lubrication than both reference fluids under most conditions. The other two C ether formulations yielded higher wear rates and friction coefficients than the C ether base fluid for most of the temperature range. Only one C ether formulation showed consistently higher steady state wear rates than the ester. M.G.

N81-21194# Lehigh Univ., Bethlehem, Pa. Materials Research Center.
***MECHANISMS OF FATIGUE DAMAGE AND FRACTURE* IN SEMI-CRYSTALLINE POLYMERS Interim Report**
Phillip E. Bretz, Richard W. Hertzberg, and John A. Manson 30 Jan. 1981 30 p refs
(Contract N00014-77-C-0633; NR Proj. 356-670)
(AD-A096068; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/9

Fatigue crack profiles and fracture surfaces of poly(vinylidene fluoride) (PVDF), nylon 66 (N66), and poly acetal (PA) were studied to ascertain the mechanisms of cyclic damage and fatigue crack propagation in semi-crystalline polymers. Crack tip damage is believed to begin as small trans-spherulitic and interspherulitic tensile crazes. However, compressive yielding within the reverse plastic zone at the crack tip crushes and elongates the spherulities in the direction of crack growth. Consequently, the microstructure of the polymer in advance of the crack front is very different from the original morphology of the spherulitic bulk material as evidenced by the resulting fracture surface appearance. When the test temperature is below the glass transition temperature, however, plastic deformation is limited, and fatigue fracture occurs before significant disruption of the spherulitic structure. In this case, the fracture surface morphology reflects the original microstructure of the bulk polymer. GRA

N81-21195*# National Aeronautics and Space Administration, Washington, D. C.
COATING OF PLASMA POLYMERIZED FILM
Shinzo Morita and Shintaro Ishibashi Dec. 1980 13 p refs Transl. into ENGLISH of Purazuma to Kagaku (Japan), Apr. 1980 p 53-57 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Namura Univ.
(Contract NASw-3199)
(NASA-TM-75845) Avail: NTIS HC A02/MF A01 CSCL 07C

Plasma polymerized thin film coating and the use of other coatings is suggested for passivation film, thin film used for conducting light, and solid body lubrication film of dielectrics of ultra insulators for electrical conduction, electron accessories, etc. The special features of flow discharge development and the polymerized film growth mechanism are discussed. E.D.K.

N81-21196*# National Aeronautics and Space Administration, Washington, D. C.

PLASMA SURFACE MODIFICATION OF POLYMERS

Toshihiro Hirotsu Dec. 1980 10 p refs Transl. into ENGLISH from Purazuma to Kagaku (Japan), Apr. 1980 p 58-61

(Contract NASw-3199)

(NASA-TM-75846) Avail: NTIS HC A02/MF A01 CSCL 07C

Thin plasma polymerization films are discussed from the viewpoint of simplicity in production stages. The application of selective, absorbent films and films used in selective permeability was tested. The types of surface modification of polymers discussed are: (1) plasma etching, (2) surface coating by plasma polymerized thin films, and (3) plasma activation surface graft polymerization. E.D.K.

N81-21197*# National Aeronautics and Space Administration, *Washington, D. C.*

HIGHLIGHTS OF 10TH PLASMA CHEMISTRY MEETING

K. Kitamura, H. Hashimoto, and K. Hozumi Feb. 1981 11 p *ref Transl. into ENGLISH of the mono. "Dai 10 Kai Purazuma* Kagaku Kenkyukai, Koen Yoshi" (Japan), 1980 p 1-6 Conf. held at Kyoto University, 28 Nov. 1980

(Contract NASw-3199)

(NASA-TM-75910) Avail: NTIS HC A02/MF A01 CSCL 07C

The chemical structure is given of a film formed by plasma polymerization from pyridine monomers. The film has a hydrophilic chemical structure, its molecular weight is 900, and the molecular *system is C55H50N1003. The electrical characteristics of a* plasma polymerized film are described. The film has good insulating properties and was successfully applied as video disc *coating. Etching resistance properties make it possible to use* the film as a resist in etching. The characteristics of plasma polymer formed from monomers containing tetramethyltin are discussed. The polymer is in film form, displays good adhesiveness, is similar to UV film UV 35 in light absorption and is highly insulating. E.D.K.

N81-21198*# National Aeronautics and Space Administration. *Lewis Research Center, Cleveland, Ohio.*

A SPUTTERED ZIRCONIA PRIMER FOR IMPROVED THERMAL SHOCK RESISTANCE OF PLASMA SPRAYED *CERAMIC TURBINE SEALS*

R. C. Bill, J. Sovey, and G. P. Allen 1981 14 p refs Presented at the 3d Intern. Conf. on Wear of Mater., San Francisco, *30 Mar. - 1 Apr. 1981 Prepared in cooperation with Army* Aviation Research and Development Command, Cleveland

(NASA-TM-81732; AVRADCOM-TR-81-C-6; E-742) Avail: *NTIS HC A02/MF A01 CSCL 07C*

The development of plasma-sprayed yttria stabilized zirconia (YSZ) ceramic turbine blade tip seal components is discussed. *The YSZ layers are quite thick (0.040 to 0.090 in.). The service* potential of seal components with such thick ceramic layers is cyclic thermal shock limited. The most usual failure mode is *ceramic layer delamination at or very near the interface between* the plasma sprayed YSZ layer and the NiCrAlY bondcoat. Deposition of a thin RF sputtered YSZ primer to the bondcoat *prior to deposition of the thick plasma sprayed YSZ layer was* found to reduce laminar cracking in cyclic thermal shock testing. The cyclic thermal shock life of one ceramic seal design was increased by a factor of 5 to 6 when the sputtered YSZ primer was incorporated. A model based on thermal response of plasma *sprayed YSZ particles impinging on the bondcoat surface with* and without the sputtered YSZ primer provides a basis for understanding the function of the primer. M.G.

N81-21199*# Battelle Columbus Labs., Ohio.

ULTRAPURE GLASS OPTICAL WAVEGUIDE DEVELOPMENT *IN MICROGRAVITY BY THE SOL-GEL PROCESS* Interim Report, 10 Apr. - 10 Nov. 1980

S. P. Mukherjee and R. A. Holman 15 Jan. 1981 30 p refs *Prepared for JPL*

(Contracts NAS7-100; JPL-955710)

(NASA-CR-164166; JPL-9950-521) Avail: NTIS *HC A03/MF A01 CSCL 11B*

Multicomponent, homogeneous, noncrystalline oxide gels can be prepared by the sol-gel process and these gels are promising *starting materials for melting glasses in the space environment.* The sol-gel process referred to here is based on the polymerization reaction of alkoxysilane with other metal alkoxy compounds or suitable metal salts. Many of the alkoxysilanes or other metal alkoxides are liquids and thus can be purified by distillation. The use of gels offers several advantages such as high purity and lower melting times and temperatures. The sol-gel process is studied for utilization in the preparation of multicomponent ultrapure glass batches for subsequent containerless melting of the batches in space to prepare glass blanks for optical waveguides. E.D.K.

N81-21200# Fluorochem, Inc., Azusa, Calif.

RESEARCH IN ENERGETIC COMPOUNDS Interim Summary *Report, 1 Mar. - 31 Dec. 1980*

Kurt Baum, Phillip T. Berkowitz, and Wayne A. Vinson Jan. 1981 48 p refs

(Contract N00014-78-C-0147; NR Proj. 093-052)

(AD-A096192; ONR-2-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

3,3-Dinitrooxetane was synthesized by the oxidative nitration of 3-nitrooxetane. 3,3-Dinitrooxetane underwent addition of triflic acid under mild conditions. Polymerization of 3-azidooxetane with BF3 gave diol with a molecular weight of 2100. Process studies were initiated to enable the preparation of larger quantities of this polymer. The reaction sequence consisted of adding acetic acid to epichlorohydrin, blocking the resulting hydroxyl with dihydropyran, cyclization with sodium hydroxide, and deblocking to give 3-hydroxyoxetane. The latter was converted to the tosylate, *which underwent displacement with sodium azide. The relatively* expensive blocking agent, dihydropyran, was replaced with ethyl vinyl ether with similar results. The yield in the tosylate preparation step was improved with 4-dimethylaminopyridine catalysis. The azide displacement step was carried out with the inexpensive and nontoxic solvent, triethylene glycol, in place of hexamethyl phosphoramide. An alternative route, consisting of the addition of IN3 to allyl alcohol followed by reaction with base, failed to *give 3-azidooxetane. Synthesis of 1-fluoro-1-nitroethylene was* improved by using alumina for the dehydration of 2-fluoro-2-nitroethanol. Polymers with molecular weight as high as *30,000 were obtained from fluorodinitroethyl glycidyl ether and* the triethylaluminum-water catalyst, but reproducibility and functionality were poor. GRA

N81-21201# Lehigh Univ., Bethlehem, Pa. Materials Research Center.

***A CORRELATION BETWEEN CRACK GROWTH RATE AND* FRACTURE MODE TRANSITIONS IN LOW-DENSITY POLYETHYLENE Interim Technical Report**

Philip E. Bretz, Richard W. Hertzberg, and John A. Manson 30 Jan. 1981 11 p refs Submitted for publication

(Contract N00014-77-C-0633; NR Proj. 356-670)

(AD-A096067; TR-8) Avail: NTIS HC A02/MF A01 CSCL 11/9

Fatigue crack propagation rates in low-density polyethylene as a function of stress intensity factor were found to exhibit a discontinuity in the range Delta K = 0.4-0.6 MPa Zeta m. Within *this range the FCP rate decreased with increasing Delta K.* Fractographic examination revealed significant differences in the appearance of the fracture surfaces corresponding to values of *Delta K below and above the transition range. While the reason* for this behavior is not clear, the nucleation and growth of voids was involved throughout; the voids being smaller at low values *of Delta K than at higher values.* GRA

N81-21202# Lehigh Univ., Bethlehem, Pa. Materials Research *Center.*

THE INFLUENCE OF ABSORBED MOISTURE ON FATIGUE CRACK PROPAGATION BEHAVIOR IN POLYAMIDES. *PART A: MACROSCOPIC RESPONSE Interim Technical* Report

Philip E. Bretz, Richard W. Hertzberg, and John A. Manson *30 Jan. 1981 35 p refs*

(Contract N00014-77-C-0633)

(AD-A096069; TR-5) Avail: NTIS HC A03/MF A01 CSCL *11/9*

The effect of plasticization on the fatigue crack propagation *response in polyamides was examined by conducting fatigue*

tests on specimens of nylon 66 (N66), nylon 6 (N6), and nylon 612 (N612) which had been equilibrated at various levels of absorbed water. In N66 and N6, crack growth rates decreased as the water content was increased to about 2.5%; with increasing moisture content, FCP rates increased and at saturation (8.5% H2O) FCP rates were higher than those observed in the dry polymer. Crack growth rates in N612 decreased monotonically as the water content increased to saturation (3.2% in this polyamide.) These results were interpreted in terms of the competition between enhanced crack tip blunting and degradation of the specimen modulus. Crack tip blunting was believed to dominate fatigue behavior at low water contents (+ or - 2.5%) and contributed to reduced FCP rates. The higher crack growth rates observed at higher moisture levels were believed to be caused by reductions in material stiffness. GRA

N81-21203# Lehigh Univ., Bethlehem, Pa. Materials Research Center.

THE INFLUENCE OF ABSORBED MOISTURE ON FATIGUE CRACK PROPAGATION BEHAVIOR IN POLYAMIDES. PART B: FRACTOGRAPHY Interim Technical Report

Phillip E. Bretz, Richard W. Hertzberg, and John A. Manson 30 Jan. 1981 34 p refs

(Contract N00014-77-C-0633; NR Proj. 356-670)

(AD-A096070; TR-6) Avail: NTIS HC A03/MF A01 CSCL 11/9

The fatigue fracture surface morphology of nylon 66, nylon 6 and nylon 612 was examined to ascertain mechanisms of fatigue crack propagation (FCP) in these polymers. Attention was also given to noting any correlation between fracture surface markings and macroscopic fatigue crack growth rate data. In general, observed changes in fracture surface appearance reflected an increasing level of plastic deformation with increasing water content, particularly in N66 and N6. Classical fatigue striations were identified in specimens of N66 and N6 containing 1.7-5.7 wt% water. Other types of fracture lineage of unknown origin were also seen which can confound the interpretation of fatigue fracture topography. Unlike the cases of N6 and N66, the fracture of N612 was dominated by a microvoid coalescence mechanism at all moisture levels and at all Delta K levels examined. GRA

N81-21204# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

MORPHOLOGY AND MECHANICAL BEHAVIOR OF BLENDS AND DIBLOCK COPOLYMERS OF 1,2 AND 1,4 POLYBUTADIENE

Robert E. Cohen and David E. Wilfong 25 Feb. 1981 63 p refs

(Contract N00014-77-C-0311)

(AD-A096260; TR-7) Avail: NTIS HC A04/MF A01 CSCL 11/9

The structure and mechanical properties of a series of polymer blends and block copolymers comprised of medium cis 1,4-polybutadiene and 99% 1,2-polybutadiene have been investigated. Thermal properties (DSC) were determined at two levels of radiation crosslinking and for various sample preparation procedures (solvent and thermal history). Dynamic mechanical spectra (3.5 Hz) were measured over temperature range from 180 to 310K. Transmission electron microscopy was also used for establishing the number phases and the domain size and geometry in the heterogeneous materials. Stress-strain curves were determined for the various samples as a function of crosslink density and casting solvent. Equilibrium swelling ratios were measured for each specimen at the same radiation dose in a good solvent. Swelling values were also obtained in a series of solvents for the parent homopolymers and for a diblock copolymer containing 45% 1,2 polybutadiene. GRA

N81-21205# Princeton Univ., N. J. Dept. of Chemical Engineering.

THE TIME-TEMPERATURE-TRANSFORMATION (TTT) STATE DIAGRAM AND ITS ROLE IN DETERMINING STRUCTURE/PROPERTY RELATIONSHIPS IN THERMOSETTING SYSTEMS Progress Technical Report, Feb. 1980 - Feb. 1981

J. K. Gillham Feb. 1981 17 p refs Submitted for publication

(Contract N00014-76-C-0200; NR Proj. 356-504)

(AD-A096127; TR-22) Avail: NTIS HC A02/MF A01 CSCL 11/9

A generalized time-temperature-transformation (TTT) state diagram for the thermosetting process is presented in which the four physical states encountered (i.e., liquid, rubber, ungelled glass and gelled glass) are related to the time and temperature of cure. Gelation and vitrification, as a consequence of quenching morphological development and chemical conversion respectively, are discussed with respect to control of material properties. GRA

N81-21206# Duke Univ., Durham, N. C. Dept. of Chemistry.

STUDY OF POLYMERIC NEMATIC PHASES Final Report, 1 May 1977 - 30 Nov. 1980

W. R. Krigbaum 12 Feb. 1981 9 p refs

(Grant DAAG29-77-G-0148)

(AD-A096032; ARO-14709.4-C) Avail: NTIS HC A02/MF A01 CSCL 11/9

An experimental determination of the persistence length of an aromatic polyamide-hydrazide, X-500, was undertaken to compare values obtained by light scattering, intrinsic viscosity, and small angle X-ray diffraction. Corrections for molecular weight heterogeneity are well known and should be applied. The status of the treatment excluded volume effects for non-Gaussian wormlike chains is not currently adequate. We were unsuccessful in an attempt to obtain experimental values of the entropy changes at the crystal-nematic and nematic-isotropic transitions for a thermotropic nematic polymer. This arose from the difficulty in identifying the nematic phase in highly viscous thermotropic polymers. Investigations of flow instabilities created by an electric field indicates this procedure may furnish a convenient conformatory test for thermotropic nematic phases. GRA

N81-21207# Northwestern Univ., Evanston, Ill.

BASIC RESEARCH ON CERAMIC MATERIALS FOR ENERGY STORAGE AND CONVERSION SYSTEMS Progress Report, 1 Dec. 1979 - 30 Nov. 1980

D. H. Whitmore Dec. 1980 64 p refs

(Contract DE-AS02-76ER-02564)

(COO-2564-6) Avail: NTIS HC A04/MF A01

Appropriate experimental probes are utilized for measuring the movement of ionic and electronic charge carriers in ceramic materials suitable for solid electrolyte and electrode applications in high performance, secondary battery, and fuel cell systems. Special emphasis is placed on developing: (1) a better understanding of the effects of structure, impurities, and composition on charge carrier transport mechanisms in such materials; and (2) detailed knowledge of the kinetics and mechanisms in such materials; and (2) detailed knowledge of the kinetics and mechanism of reactions occurring (on a microscopic scale) at the electrode-electrolyte interfaces of energy storage and conversion systems. DOE

N81-21208# Eaton Corp., Southfield, Mich. Engineering and Research Center.

LABORATORY EVALUATION OF CERAMIC COATINGS FOR DIESEL EXHAUST VALVES Final Technical Report

David H. Scharnweber and Dennis T. Vukovich Nov. 1980 77 p refs

(Contract DE-AC03-79ET-15320)

(DOE/ET-15320-T3) Avail: NTIS HC A05/MF A01

Diesel engine exhaust valves coated with zirconia and calcium silicate ceramic coating systems were laboratory fixture tested to assess bond strength and structural integrity under representative mechanical and thermal stress conditions. The results indicate the zirconia coating systems are worthy of additional evaluation in a medium or high speed industrial/utility diesel engine. DOE

N81-21209# General Electric Co., Philadelphia, Pa.

DESIGN AND DEVELOPMENT OF A REINFORCED PLASTIC TROUGH MODULE

Feb. 1981 103 p refs Prepared for Sandia Labs., Albuquerque, N. Mex.

(Contract DE-AC04-76DP-00789)

(SAND-80-7150) Avail: NTIS HC A06/MF A01

A reinforced plastic trough design compatible with the line focus photovoltaic concentrator requirements and reinforced

plastic molding process considerations is described. In addition a summary of the prototype mold and plastic trough fabrication effort is provided. Finally the specific mold and part test and evaluation results are reviewed. M.G.

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-21210*# Battelle Memorial Inst., Geneva (Switzerland).
DIRECT THERMAL WATER SPLITTING BY CONCENTRATED SOLAR RADIATION FOR HYDROGEN PRODUCTION. PHASE O: PROOF OF CONCEPT EXPERIMENT Final Report
P. Genequand Jun. 1980 59 p refs Sponsored in part by DOE
(Contracts NAS7-100; JPL-955277)
(NASA-CR-164137; JPL-9950-512) Avail: NTIS HC A04/MF A01 CSCL 21D

The direct production of hydrogen from water and solar energy concentrated into a high temperature aperture is described. A solar powered reactor able to dissociate water vapor and to separate the reaction product at high temperature was developed, and direct water splitting has been achieved in a laboratory reactor. Water vapor and radiative heating from a carbon dioxide laser are fed into the reactor, and water vapor enriched in hydrogen and water vapor enriched in oxygen are produced. The enriched water vapors are separated through a separation membrane, a small disc of zirconium dioxide heated to a range of 1800 k to 2800 k. To avoid water vapor condensation within the reactor, the total pressure within the reactor was limited to 0.15 torr. A few modifications would enable the reactor to be operated at an increased pressure of a few torrs. More substantial modifications would allow for a reaction pressure of 0.1 atmosphere.
J.D.H.

N81-21211*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
AN INVESTIGATION OF AIR SOLUBILITY IN JET A FUEL AT HIGH PRESSURES Semiannual Status Report, 1 Sep. 1980 - 28 Feb. 1981
G. M. Faeth Mar. 1981 26 p refs
(Grant NsG-3306)
(NASA-CR-154170; SASR-3) Avail: NTIS HC A03/MF A01 CSCL 21D

Problems concerned with the supercritical injection concept are discussed. Supercritical injection involves dissolving air into a fuel prior to injection. A similar effect is obtained by preheating the fuel so that a portion of the fuel flashes when its pressure is reduced. Flashing improves atomization properties and the presence of air in the primary zone of a spray flame reduces the formation of pollutants. The investigation is divided into three phases: (1) measure the solubility and density properties of fuel/gas mixtures, including Jet A/air, at pressures and correlate these results using theory; (2) investigate the atomization properties of flashing liquids, including fuel/dissolved gas systems. Determine and correlate the effect of inlet properties and injector geometry on mass flow rates, Sauter mean diameter and spray angles; (3) examine the combustion properties of flashing injection in an open burner flame, considering flame shape and soot production. S.F.

N81-21212*# Beech Aircraft Corp., Boulder, Colo.
CONCEPTUAL DESIGN OF AN IN-SPACE CRYOGENIC FLUID MANAGEMENT FACILITY, EXECUTIVE SUMMARY Final Report
G. S. Willen, D. H. Riemer, and D. C. Hustvedt Apr. 1981 36 p refs
(Contract NAS3-22260)
(NASA-CR-165279-Exec-Summ; BAB-ER-14967-Exec-Summ) Avail: NTIS HC A03/MF A01 CSCL 21H

The conceptual design of a Spacelab experiment to develop the technology associated with low gravity propellant management is summarized. The preliminary facility definition, conceptual design and design analysis, and facility development plan, including schedule and cost estimates for the facility, are presented. J.D.H.

N81-21213*# Beech Aircraft Corp., Boulder, Colo.
CONCEPTUAL DESIGN OF AN IN-SPACE CRYOGENIC FLUID MANAGEMENT FACILITY
G. S. Willen, D. H. Riemer, and D. C. Hustvedt Apr. 1981 229 p refs
(Contract NAS3-22260)
(NASA-CR-165279; BAC-ER-14967) Avail: NTIS HC A11/MF A01 CSCL 21H

The conceptual design of a Spacelab experiment to develop the technology associated with low gravity propellant management is presented. The proposed facility consisting of a supply tank, receiver tank, pressurization system, instrumentation, and supporting hardware, is described. The experimental objectives, the receiver tank to be modeled, and constraints imposed on the design by the space shuttle, Spacelab, and scaling requirements, are described. The conceptual design, including the general configurations, flow schematics, insulation systems, instrumentation requirements, and internal tank configurations for the supply tank and the receiver tank, is described. Thermal, structural, fluid, and safety and reliability aspects of the facility are analyzed. The facility development plan, including schedule and cost estimates for the facility, is presented. A program work breakdown structure and master program schedule for a seven year program are included. J.D.H.

N81-21214# Computer Sciences Corp., Bay St. Louis, Miss. Technical Services Lab.
A COMPILATION OF HAZARD AND TEST DATA FOR PYROTECHNIC COMPOSITIONS Final Report, Jan. 1969 - Mar. 1979
Fred L. McIntyre and Richard M. Rindner Oct. 1980 382 p refs
(AD-A096248; AD-E400496; ARLCD-CR-80047) Avail: NTIS HC A17/MF A01 CSCL 19/1

This report is a compilation of parametric, stability, sensitivity, and output data on selected pyrotechnic compositions derived from hazards evaluation and classification testing. Additional results of manufacturing processes and process equipment were studied, and the results of an incident/accident survey are included in this report. This report provides a readily accessible source of data for some 180 pyrotechnic compositions. GRA

N81-21215# Federal Aviation Administration, Atlantic City, N.J.
WING SPILLAGE TESTS USING ANTIMISTING FUEL Final Report, Mar. 1979 - Nov. 1980
Robert F. Salmon Feb. 1981 55 p refs
(FAA Proj. 181-520-100)
(AD-A096326; FAA-CT-81-11) Avail: NTIS HC A04/MF A01 CSCL 21/4

Fuel spillage tests were conducted to evaluate the performance of an antimisting fuel (FM-9 with glycol/amine carrier fluid) in a simulated crash environment. The results of the tests are: (1) FM-9 when compared with neat Jet A afforded flammability protection even under test conditions which resulted in a 'fail' for the FM-9; (2) 0.3% 80 F FM-9 provided excellent fire resistance at air-shearing velocities up to 125 knots; (3) spillage rates from 20 to 60 gallons per second yielded similar results; (4) fuel temperature impacted the antimisting performance of the fuel, 47 fuel and 110 F fuel provided fire resistance at air-shearing velocities of 133 and 116 knots, respectively; (5) additive concentration affected fire resistance performance with 0.2 percent and 0.35 percent providing protection at air-shearing velocities of 99 knots and 142 knots, respectively; (6) MK40 rockets used as an ignition source did not alter the basic fire resistance properties of the fuel; (7) the height above the ground of the fuel release point did not affect the test results; (8) the discharge orifice shape did not affect the tests results; (9) engine fuel ingestion tests indicated that fuel quantity ingested was the governing factor as to whether engine surge occurs; (10) deceleration tests indicated that the safety range of FM-9 is about 30 knots higher in deceleration tests versus steady-state spillage tests. GRA

N81-21216# Tennessee Valley Authority, Muscle Shoals, Ala. Div. of Chemical Development.
ENVIRONMENTAL CONSIDERATION FOR TVA'S AMMONIA FROM COAL PROJECT
P. C. Williamson and D. A. Waitzman 1980 18 p Presented at the Fertilizer Inst. Environ. Symp., New Orleans, 7-10 Apr. 1980
(CONF-8004137-1) Avail: NTIS HC A02/MF A01

The project involves retrofitting a coal gasification process to the front end of its existing 225 ton-per-day ammonia plant. The purpose of the project is to develop design and operating data to assess the technological, economic, and environmental aspects of substituting coal for natural gas in the manufacture of ammonia. The gasification plant and process are described. Solid wastes are to be disposed of in a sanitary landfill. Precautionary measures are described. Environmental study areas are outlined. These include: gaseous, liquid, and solid waste monitoring and characterization; radiological characterization; medical surveillance; and basic industrial hygiene. Possible hazardous agents are described. DOE

N81-21217# Department of Energy, Grand Forks, N. Dak. Grand Forks Energy Technology Center.
OBSERVATIONS ON TEST STOCKPILES OF DRIED LIGNITE AND SUBBITUMINOUS COALS
S. A. Cooley, L. E. Paulson, and R. C. Ellman 1981 14 p refs
(DOE/GFETC/RI-80/5) Avail: NTIS HC A02/MF A01

Dried low rank coal stockpiles were monitored from 1974 to 1980. Moisture content, heating value, and pile temperature showed little changes since compaction. Indications are that dried coal can be stockpiled for extended periods. DOE

N81-21218# Air Products and Chemicals, Inc., Allentown, Pa.
CRYOGENIC METHANE SEPARATION/CATALYTIC HYDROGASIFICATION PROCESS ANALYSIS Quarterly Report
J. Kiosek 2 Dec. 1980 17 p
(Contract DE-AC01-78ET-10325)
(DOE/ET-10325/T3) Avail: NTIS HC A02/MF A01

Trade-off and optimization studies are reported for the Short Residence Time Hydrogasification (SRTH) and the Catalytic Coal Gasification (CCG) processes in the acid gas removal and cryogenic separation areas. Subtasks include block flow sheet, overall heat and material balance, utility summary, four-line equipment description, investment and treatment cost summaries and final report writing in addition to monthly and quarterly reports. DOE

N81-21219# Oregon Inst. of Tech., Klamath Falls. Geo-Heat Utilization Center.
ETHANOL: A BRIEF ECONOMIC EVALUATION
Sep. 1980 12 p
(Contract DE-AC79-79BP-15325)
(DOE/BP-15325-T8) Avail: NTIS HC A02/MF A01

The feasibility of a 10 million gallon per year ethanol plant is considered. The initial feed to the plant would be corn, with sugar beets as a possible alternate feed. The ultimate plan is to use waste products and biomass feed stocks. Geothermal water would provide the necessary process heat for the plant. An economic evaluation was performed to assist the owners in their planning. Over a 20 year period, the plant using a corn feed stock would generate a rate of return of +12% on a total equity capital investment of $33,000,000. Over a 15 year period, the plant using a corn feed stock is probably not economically feasible since it would have a rate of return less than 12% or a total equity capital investment of $33,000,000. A corn feed stock plant operates at a loss for the first seven years if 95% of the $33,000,000 cost is debt financed. The plant is economically feasible only if offsetting energy income from other profitable operation permits taking advantage of investment tax credits and depletion allowances that are available. DOE

N81-21220# Department of Energy, Washington, D. C.
ALTERNATIVE FUELS PRODUCTION PROGRAM Semiannual Report
Nov. 1980 188 p
(DOE/RA-0058/2) Avail: NTIS HC A09/MF A01

The provisions of Public Law 96-126 and subsequent legislation by Congress, applicable to the alternative fuels production program are described. Emphasis is placed on program strategies and objectives as well as specific implementation approaches. Results of several feasibility studies conducted under the program are presented. R.C.T.

N81-21221# Institute of Gas Technology, Chicago, Ill.
METHANE PRODUCTION FROM MARINE BIOMASS
David P. Chynoweth and Vipul J. Srivastiava 1980 27 p refs Presented at the Intern. Symp. on Biogas, Microalgae, and Livestock Wastes, Taipei, Taiwan, 15-17 Sep. 1980
(Contract DE-AC01-76ET-10163)
(CONF-8009123-1) Avail: NTIS HC A03/MF A01

The overall concept of the giant brown kelp farm and conversion system, the integrated research program engaged in its study, work on biogasification process development are discussed. A summary of results on anaerobic digestion is emphasized. DOE

N81-21222# Gulf Research and Development Co., Pittsburgh, Pa.
INVESTIGATION OF THE LIQUEFACTION OF PARTIALLY DRIED AND OXIDIZED COALS Final Report
D. C. Cronauer, R. G. Ruberto, R. S. Silver, R. J. Jenkins (Pennsylvania State Univ.), and A. Davis (Pennsylvania State Univ.) Nov. 1980 177 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 779-25)
(EPRI-AP-1625) Avail: NTIS HC A09/MF A01

The effect of predrying and partial oxidation on the liquefaction behavior of subbituminous coal was examined. It was found from both micro and bench scale experiments that the drying of Belle Ayr subbituminous coal, even in nitrogen, results in a significant reduction of product yields when a comparison is made to similar runs using as-received coal. A further reduction occurs when the drying gas contains oxygen. As observed from a microscopic study of the reaction product residues, the yield reduction is due in part to a prepolymerization of coal liquid products resulting in a sizable portion of coke-like solids. Samples of both Belle Ayr subbituminous and Powhatan bituminous coals were dried in various gases in three scales of equipment, namely, TGA and laboratory and bench-scale fluid bed units. The rates and maximum levels of coal oxidation are discussed. It is noted that the lower rank coal oxidizes more readily, but the maximum up-take of oxygen is only about 4 wt % while that of the higher rank coal is about 8 wt %. DOE

N81-21223# Oak Ridge National Lab., Tenn. Chemical Technology Div.
LIQUEFACTION TECHNOLOGY ASSESSMENT, PHASE 1: INDIRECT LIQUEFACTION OF COAL TO METHANOL AND GASOLINE USING AVAILABLE TECHNOLOGY
R. M. Wham, J. F. Fisher, R. C. Forrester, III, A. R. Irvine, R. Salmon, S. P. N. Singh, and W. C. Ulrich Feb. 1981 403 p refs
(Contract W-7405-eng-26)
(ORNL-5864) Avail: NTIS HC A16/MF A01

Major liquefaction technologies employed were ICI low pressure methanol synthesis and Mobil-MTG conversion of methanol to gasoline. Four major cases were studied, representing different product slates. In each case, the economic study was based on the detailed process design of a conceptual, self sufficient, commercial facility using a coal feed rate to the gasifiers of 16,000 tons per stream day on a moisture and ash-free basis. This corresponds to a total as-received coal feed rate of about 30,000 TPSD to the facility. Process designs, equipment summaries, cost estimates, and operating requirements were prepared. Economic sensitivity studies showed that the two factors having the greatest influence on product price were the method of financing and the inclusion of escalation of inflation. Depending on the financing assumptions, the initial gasoline selling price in 1979 dollars varied from $0.78 to $1.25/gallon. This price must be escalated at 6%/yr to obtain the price in the start-up year, or in any other year of operation. DOE

N81-21224# Battelle Pacific Northwest Labs., Richland, Wash.
METHANOL PRODUCTION WITH ELEMENTAL PHOSPHO-

RUB BYPRODUCT GAS: TECHNICAL AND ECONOMIC FEASIBILITY
S. E. Lyke Jan. 1981 200 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3694) Avail: NTIS HC A09/MF A01

The technical and economic feasibility of using a phosphorus byproduct stream as a substitute for part of the natural gas in methanol production is assessed. Economic tradeoffs between several alternative methods of supplying the necessary hydrogen gas for methanol production are established. A preliminary basic design of a plant to clean and compress the off gas, return recovered phosphorus to the phosphorus plant, and produce methanol by using the phosphorus off gases is presented. Detailed economic analyses of the production of elemental phosphorus and methanol, a methanol plant feasibility study, and methanol market study are presented. J.D.H.

N81-21225# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Pantex Plant.
RE-ESTABLISHMENT OF FRICTION SENSITIVITY AS A STANDARD TEST, PROCESS DEVELOPMENT ENDEAVOR NO. 301
Elisha L. Demerson Feb. 1981 13 p
(Contract DE-AC04-76DP-00487)
(MHSMP-81-12) Avail: NTIS HC A02/MF A01

The friction sensitivity test was re-established following movement of the machine to a new location required by intraline distance considerations. An epoxy resin without silver was evaluated for bonding the silica sand to the initiation strap. The epoxy without silver was found to give more reproducible results than the previous epoxy containing silver. The friction sensitivities of fourteen explosives were determined. DOE

N81-21226# Sandia Labs., Albuquerque, N. Mex. Explosives Testing Div.
PERFORMANCE OF A COMMERCIAL BACKSCATTER INSTRUMENT ADAPTED FOR NONCONTACTING AREAL DENSITY MEASUREMENTS ON SMALL-DIAMETER SURFACES
P. B. Higgins Dec. 1980 27 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2126) Avail: NTIS HC A02/MF A01

Measuring the local areal density of a small diameter surface requires noncontacting technique and good resolution. The side effects of spacing the sensing platen of an NX-500 Betascope 2.54 mm from the surface of cylinders as small as 13 mm diameter are examined. Resolution in two directions and offset error sensitivity of the system are defined and determined using coatings of simulated explosive. An eddy current system is described which can be easily added to reduce offset errors caused by fixture misalignment. DOE

N81-21227# Argonne National Lab., Ill. Chemical Engineering Div.
EXPLORATORY AND BASIC FLUIDIZED-BED COMBUSTION STUDIES Quarterly Report, Oct. - Dec. 1979
Irving Johnson, K. M. Myles, W. M. Swift, R. F. Henry, G. Morales, D. S. Moulton, J. A. Shearer, F. G. Teats, C. B. Turner, and W. I. Wilson Nov. 1980 46 p refs
(Contract W-31-109-eng-38; EPA-IAG-D5-E681)
(ANL/CEN/FE-80-7) Avail: NTIS HC A03/MF A01

Laboratory and process development scale studies support the fossil energy development program for atmospheric and pressurized fluidized-bed combustion are discussed with emphasis on methods for improving the utilization of limestone for SO2 emission control in FBCs and for predicting the performance in AFBC's and PFBC's of limestones from different sources. Results are presented from: (1) an investigation of the use of water treatment of spent partially sulfated limestone to enhance its SO2 capture capacity; (2) studies of the kinetics of the hydration of spent limestone; (2) studies of the attrition and elutriation of limestones in fluidized bed; and (4) studies of the particle-removal efficiency of the TAN-JET cyclone are also reported. DOE

N81-21228# Argonne National Lab., Ill. Materials Science Div.
MATERIALS TECHNOLOGY FOR COAL-CONVERSION PROCESSES Progress Report, Apr. - Jun. 1980
William A. Ellingson Oct. 1980 70 p refs
(Contract W-31-109-eng-38)
(ANL-80-93) Avail: NTIS HC A04/MF A01

High chromia content and high density were identified as important factors in minimizing corrosion of refractories. Results from the high temperature nondestructive erosion scanner revealed the presence of a hard film composed of Cr, Fe, S, and O2 which reduced erosive wear which is acoustically transparent. Further improvements in the erosion scanner data acquisition system through employment of a correction for through wall thermal gradients reduced data scatter. Qualitative detection of internal liquid leaks past critical valves in coal liquefication plants seems possible through use of low velocity ultrasonic or strain sensitive flowmeters together with passive acoustic systems. Studies of high temperature gaseous corrosion of low Btu environments show that the potential exists for sulfide attack even in high chromium alloys such as 310 SS. Failure analysis activities included analysis of a failed internal transfer line and a thermocouple sheath. DOE

N81-21229# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ECONOMIC COMPARISON OF MOLTEN CARBONATE FUEL CELLS AND GAS TURBINES IN COAL GASIFICATION BASED POWER PLANTS Final Report
C. D. Crawford, R. P. Dawkins, and J. R. Joiner Sep. 1980 444 p
(EPRI Proj. 239-2)
(EPRI-AP-1543) Avail: NTIS HC A19/MF A01

The results of screening type process evaluation for heat integration of coal gasification processes with two alternate advanced combined cycle power generation systems are presented. One system was composed of a molten carbonate fuel cell prime cycle and a steam bottoming cycle. The second system contained a 2600 F gas turbine prime cycle and a steam bottoming cycle. The three coal gasification processes utilized included the oxygen blown entrained gasifier, the air blown entrained gasifier, and the slagging gasifier. DOE

N81-21230# RANN, Inc., Palo Alto, Calif.
COMPARATIVE ANALYSIS OF COAL USE OPTIONS FOR REDUCING THE DEPENDENCE OF UTILITIES ON IMPORTED OIL
A. J. Eggers, Jr. 3 Jan. 1980 54 p refs
(Contract DE-AC01-78RA-12301)
(DOE/RA-12301-T1) Avail: NTIS HC A04/MF A01

The conversion of utilities from oil-fired to coal-fired to yield an import reduction of 0.75 MBD by 1990. It is indicated, therefore, that the program development and management techniques employed in the Apollo Polaris, and Minuteman programs may have useful application to the utility conversion program. These techniques include comparative systems and mission mode analysis, and the application of these techniques to the utility conversion program is discussed. It is suggested that DOE/RA initiate an in-house task force effort to make a comparative analysis of conversion alternatives to meet this goal. This analysis is discussed in some detail and it should consider the coal delivery as well as the conversion elements of the overall coal use system with a view to focusing on problems which must be addressed. DOE

N81-21231# Sandia Labs., Albuquerque, N. Mex.
CATALYTIC EFFECTS IN COAL GASIFICATION Quarterly Report, Apr. - Jun. 1980
T. D. Padrick Nov. 1980 18 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2151) Avail: NTIS HC A02/MF A01

The effects of mineral matter on the devolatilization of coal and on the subsequent char gasification were determined. Eastern bituminous coals whose mineral matter content, as determined by X-ray analysis of low temperature ash, ranged from less than 5% to more than 20% were selected for study. Chemical and physical characterization revealed that these coals had similar rank and petrographic content. Baseline thermal gravimetric experiments, in which the coals were heated from ambient to 1000 C at 5 C/min under nitrogen or hydrogen, were completed. Also, the composition of the gas evolved during both the devolatization regime and the subsequent period of slower char gasification was measured. J.M.S.

N81-21232# General Accounting Office, Washington, D. C. Energy and Minerals Div.
LIQUEFYING COAL FOR FUTURE ENERGY NEEDS
12 Aug. 1980 43 p refs
(PB81-135956; EMD-80-84) Avail: NTIS HC A03/MF A01 CSCL 07A

Coal liquefaction is a technology which can augment petroleum derived products such as gasoline and boiler fuels. There are no commercial plants operating or under construction in the United States for either of the two types of coal liquefaction direct and indirect. If any portion of the national goals for synthetic fuels is to be met with coal liquefaction, the bulk of the production is likely to come from the indirect processes. GRA

N81-21233# Office of Technology Assessment, Washington, D. C.
ENERGY FROM BIOLOGICAL PROCESSES. VOLUME 2: TECHNICAL AND ENVIRONMENTAL ANALYSES
Jul. 1980 228 p refs
(PB81-134769; OTA-E-128; LC-80-600118) Avail: NTIS HC A11/MF A01 CSCL 21D

Forestry, agriculture, procesing wastes, and various unconventional energy sources including oil-bearing and aquatic plants are considered. Energy conversion technologies discussed include thermochemical conversions, fermentation by ethanol production, anaerobic digestion, use of alcohol fuels, select energy balances, and chemicals from biomass. Technical, economic, and environmental details are presented and analyzed. GRA

N81-21234# Washington Univ., Seattle. Coll. of Forest Resources.
ENERGY FROM BIOLOGICAL PROCESSES. VOLUME 3: APPENDIXES. PART A: ENERGY FROM WOOD
James S. Bethel, David G. Briggs, Lorenzo Garay, Stanley P. Gessel, William D. Kitto, Warren F. Lake, Amadeo J. Rossi, Gerald F. Schreuder, David A. Tillman, and Larry G. Zuller Jul. 1980 387 p refs
(PB81-134777; OTA-C-78-339) Avail: NTIS HC A17/MF A01 CSCL 21D

The feasibility of fostering further substitution of wood for fossil fuels was assessed. It is concluded that there is a surplus of wood that could be used for fuel in substitution for fossil fuels, and, on a renewable basis, this supply could be very substantially increased if it were national policy to do so. GRA

N81-21235# Office of Technology Assessment, Washington, D. C.
ENERGY FROM BIOLOGICAL PROCESSES. VOLUME 3: APPENDIXES. PART B: AGRICULTURE, UNCONVENTIONAL CROPS, AND SELECTED BIOMASS WASTES Final Report
Jul. 1980 856 p refs 3 Vol.
(PB81-134785) Avail: NTIS HC A99/MF A01 CSCL 21D

Working papers presented include: The Potential of Producing Energy From Agriculture; Cropland Availability for Biomass Production; Energy From Agriculture; Unconventional Crops; Energy From Aquaculture Biomass Systems; Fresh and Brackish Water Aquatic Plants; Energy From Agriculture; Animal Wastes; and Energy From Agriculture; Agricultural Processing Wastes. GRA

N81-21236# Office of Technology Assessment, Washington, D. C.
ENERGY FROM BIOLOGICAL PROCESSES. VOLUME 3: APPENDIXES. PART C: SELECTED CONVERSION TECHNOLOGIES AND END USE
Sep. 1980 719 p refs 3 Vol.
(PB81-134793) Avail: NTIS HC A99/MF A01 CSCL 21D

Contents: End Use of Fluids from Biomass as Energy Resources in Both Transportation and Nontransportation Sectors; Thermochemical Conversion of Biomass: The Scientific Aspects; Engineering Aspects of Thermochemical Conversion; and Biological Production of Gas. GRA

N81-21237# Textron, Inc., Buffalo, N. Y.
COAL GASIFIER WALL PROTECTION SYSTEM Report, 15 Jan. 1979 - May 1980
Dale M. Slaughter Apr. 1980 132 p refs Sponsored by New York State Energy Research and Development Authority
(PB81-141921; NYSERDA-80-5) Avail: NTIS HC A07/MF A01 CSCL 21D

When coal is converted to other forms, as much as 5 to 30 percent of it is left as ash. That ash can foul the interior of the conversion system, cutting efficiency, and sometimes causing total shut down. Molten or solidified ash (slag) build up occurs in coal gasifiers where temperatures are so high that the ash melts. Finding materials and developing designs to eliminate slag accumulation are emphasized. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-21238# Electrotechnical Lab., Ibaraki (Japan).
HELIUM TURBO-EXPANDER WITH AN ALTERNATOR: LARGE HELIUM REFRIGERATOR-LIQUEFIER SYSTEM
Yoshitane Akiyama Jul. 1980 83 p refs In JAPANESE; ENGLISH summary
(Rept-807) Avail: NTIS HC A05/MF A01

The requirements for practical use of the large scale helium refrigerator system are considered. As a long continuous operation is required, the life time of the system should be approximately as long as that of other electrical machines. The refrigerator should be connected directly to the superconducting system by circulation of coolant (liquid or gaseous helium). In this case, an accident of the refrigerator system causes a fatal breakdown of the full system. The contamination in the circulating helium should be avoided. The efficiency of the refrigerator system should be as high as possible. The control method must be established so that the refrigerator can be operated for a long period by a few operators. A helium turbo-expander with externally pressurized helium gas bearings at the temperature of liquid nitrogen and an alternator as a brake was employed for the investigation. E.D.K.

N81-21239# Sonobond Corp., Westchester, Pa.
ULTRASONIC COLD FORMING OF AIRCRAFT SHEET MATERIALS Final Report, Dec. 1978 - Nov. 1980
Janet Devine and Philip C. Krause Army Aviation Research and Development Command Jan. 1981 62 p refs Prepared in cooperation with Hughes Helicopters
(Contract DAAG46-79-C-0001)
(AD-A096351; RR-80-8; USAAVRADCOM-TR-81-F-3; AMMRC-TR-81-1) Avail: NTIS HC A04/MF A01 CSCL 13/8

Ultrasonic forming was investigated as a means for shaping aircraft sheet materials, including titanium 6Al-4V alloy, nickel, and stainless steel AM355-CRT, into a helicopter rotor blade nosecap contour. Equipment for static forming of small coupons consisted of a modified 4000 watt ultrasonic spot welder provided with specially designed punch and die sets. The titanium alloy was successfully formed to a 60 degree angle in one step with ultrasonics, but invariably cracked under static force alone. Nickel had a low enough yield strength that it could be successfully formed either with or without ultrasonics. Insufficient ultrasonic power was available to produce beneficial effect with the high-strength steel. From analogy with commercially used ultrasonic tube drawing, it was postulated that dynamic forming of long lengths of the nosecap geometry could be achieved with an ultrasonic system mounted on a draw bench. It was recommended that the ultrasonic technique be considered for forming other aircraft sheet geometries, particularly involving titanium alloy. GRA

N81-21240# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
FIELD EVALUATION OF INTERNALLY SEALED CONCRETE Final Report, 1976 - 1979
R. J. Spring, D. R. Smith, B. F. Neal, and J. H. Woodstrom Feb. 1980 80 p refs
(Contract DOT-D-3-58)
(PB81-130023; TL-635350; FHWA/CA/TL-80-05) Avail:

NTIS HC A05/MF A01 CSCL 13B

Portland cement concrete containing wax beads was evaluated. Performance of the deck concrete was evaluated after a little more than three years of service. The deck was found to be badly cracked. From cores, it was determined that the cracks extended at least to the reinforcing steel, and in some cases, entirely through the 8 1/2 inch deck. It is concluded from an examination of the cracked faces of cores that cracking was probably caused by shrinkage of the fresh concrete due to some slight delay in curing. A dry wind was blowing during concrete placement, creating adverse curing conditions. GRA

N81-21241# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.

LONG-TERM PERFORMANCE OF THE FIRST REINFORCED EARTH WALL IN CALIFORNIA Final Report

Joseph B. Hannon, Jerry C. Chang, and Bobby L. Lister Aug. 1980 70 p refs

(Contract DOT-D-4-143)

(PB81-128100; TL-632166; FHWA/CA/TL-80/27) Avail: NTIS HC A04/MF A01 CSCL 13B

The long term performance of the first reinforced earth wall is reported. Field instrumentation since 1974 indicated a continuing outward movement of the wall face at the south flank. Various remedial measures were instituted to improve wall stability. Final instrumentation measurements suggest continuing increases in strain of embedded reinforcing strips. Significant reductions in strain rates occurred since completion of additional buttressing and embankment reshaping. The embankment and foundation system is still readjusting to remedial measures. A condition survey revealed that the overall appearance of this facility is good. GRA

N81-21242# California Univ., Berkeley. Earthquake Engineering Research Center.

HYBRID MODELLING OF SOIL-STRUCTURE INTERACTION

Sunil Gupta, Tsung-Wu Lin, Joseph Penzien, and Chang-Shioung Yeh May 1980 128 p refs

(Grant NSF ENV-77-06006)

(PB81-122319; UCB/EERC-80/09; NSF/RA-800195) Avail: NTIS HC A07/MF A01 CSCL 13M

A hybrid for the analysis of soil-structure interaction is proposed. The modelling is achieved by partitioning the total soil-structure system into a near-field and a far-field with hemispherical interface. The near-field, which consists of the structure to be analyzed and a finite region of soil around it, is modelled by the finite element method. For the semi-infinite far-field, impedance matrix corresponding to the interface degrees of freedom is developed which accounts for the loss of energy due to wave traveling away from the foundation. For torsional vibrations, the far-field impedance matrix can be determined analytically. GRA

N81-21243# California Univ., Berkeley. Earthquake Engineering Research Center.

INELASTIC TORSIONAL RESPONSE OF STRUCTURES SUBJECTED TO EARTHQUAKE GROUND MOTIONS

Yutaka Yamazaki Apr. 1980 165 p refs

(Grant NSF PFR-79-08261)

(PB81-122327; NSF/RA-800193; UCB/EERC-80/07) Avail: NTIS HC A08/MF A01 CSCL 13M

The objectives are to identify the basic parameters which control the earthquake response of torsionally coupled systems composed of resisting elements providing force interaction during yielding; to clarify differences in response between systems subjected to single-component ground motion and systems subjected to double-component ground motion; to clarify differences in response among an elastic system, an elasto-plastic system without force interaction, and an elasto-plastic system with force interaction; and to evaluate the effects of magnitude of eccentricity and magnitudes of yield shear forces on the response of elasto-plastic systems with force interaction. GRA

N81-21244# Management of Resources and the Environment, Glastonbury, Conn.

MUNICIPAL SOLID WASTE DISPOSAL IN ESTUARIES AND COASTAL MARSHLANDS Final Report

Kenneth A. MacGregor, Michael S. Klein, Johanna S. Bazzolo, and Mary Ellen Delaney Dec. 1980 183 p refs

(Contract EPA-68-03-2517)

(PB81-129223; EPA-600/2-80-212) Avail: NTIS HC A09/MF A01 CSCL 13B

The existing situation with regards to municipal solid waste disposal in the coastal zone was assessed. Both the scientific literature and the regulatory community were surveyed to determine the state of knowledge of the impact of such disposal on the environment, past and present disposal techniques, and the attitudes of the regulatory community. GRA

N81-21245# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.

BEACHES: PROFILES, PROCESSES AND PERMEABILITY

M. R. Gourlay Jun. 1980 44 p refs

(PB81-136020; RR-CE-14) Avail: NTIS HC A03/MF A01 CSCL 13B

The problems involved in the interaction between waves and beaches are complex and it is not yet possible to predict on empirical grounds, let alone theoretical grounds, the shape of a beach after it is subjected to given wave conditions. This investigation began as a study of the use of crushed coal as a model beach material to represent natural beaches of quartz sand but subsequently developed into a more general study of the processes which determine the shape of beach profiles formed in beach materials with different permeabilities. GRA

N81-21246# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.

AN INVESTIGATION OF THE EFFECTIVENESS OF ASPHALT DURABILITY TESTS Final Report

N. H. Predoehl and Glenn R. Kemp May 1980 102 p refs

(PB81-132292; TL-633133; FHWA/CA/TL-80/14; FHWA-CA/TL-78-26; FHWA-D-3-54) Avail: NTIS HC A06/MF A01 CSCL 13C

Included are analyses which show that the effects of voids and aggregate porosity are less severe than the thermal oxidation effect in hot desert climates. A comparison of the results of laboratory tests for predicting asphalt hardening with the results for the field weathered briquettes show that none of the procedures is capable of adequately predicting asphalt weathering in a hot weathering site. A procedure was developed to approximate the effect produced at Indio in two years. Some correlation to briquette results was obtained. A climatic specification to control asphalt hardening in the hot climatic areas is proposed. GRA

N81-21247# Transportation Research Board, Washington, D.C.

CONCRETE PAVEMENTS AND PAVEMENT OVERLAYS

Gary E. Elkins, Freddy L. Roberts, Thomas W. Kennedy, B. Frank McCullough, J. C. M. Ma, C. S. Noble, Stephen Seeds, W. R. Hudson, and Manuel Gutierrez deVelasco 1980 57 p refs

(PB81-132458; TRB/TRR-756; LC-80-607860; ISBN-0-309-03070-6) Avail: NTIS HC A04/MF A01; Paper copy also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418 CSCL 13B

Material property requirements for zero maintenance of continuously reinforced concrete pavements, limiting criteria for the design of continuously reinforced concrete pavements, and nomographs for the design of steel reinforcement in continuously reinforced concrete pavement are discussed. Other topics include implementation of an overlay design procedure in Texas, prevention of reflective cracking in Arizona, dynamic surface deflection measurements on rigid pavements compared with the model of an infinite plate on an elastic foundation, and fatigue cracking of asphalt pavements. GRA

N81-21248# Transportation Research Board, Washington, D.C. Commission on Sociotechnical Systems.

EVALUATION AND ANALYSIS OF FLEXIBLE PAVEMENT COMPONENTS AND PROPERTIES

Freddy L. Roberts, Thomas W. Kennedy, M. C. Wang, W. L. Gramling, A. F. Stock, S. F. Brown, Paul A. D'Amato, Matthew W. Witczak, Lynne G. Cowe Falls, Ralph Haas et al 1980 60 p refs

(PB81-132532; TRB/TRR-755; ISBN-0-309-03068-4; ISSN-0361-1981; LC-80-26335) Avail: NTIS

HC A04/MF A01 CSCL 13B

Eight topics are examined: material properties of zero maintenance flexible pavement; distress behavior of flexible pavements that contain stabilized base courses; nonlinear characterization of granular materials for asphalt pavement design; analysis of in situ granular layer modulus from dynamic road rater deflections; pavement design for permafrost conditions; structural and thermal requirements; laboratory investigation of flexible pavement response by using transfer functions; evaluation of pavement in Florida by using the falling weight deflectometer; and reinforcement of transportation support systems through fabric prestressing. GRA

N81-21249# National Bureau of Standards, Washington, D.C. Center for Building Technology.

WEATHERIZATION INVESTMENT COSTS FOR LOW-INCOME HOUSING Final Report

Stephen F. Weber, Michael J. Boehm, and Barbara C. Lippiatt Nov. 1980 83 p refs Sponsored in part by Community Services Administration, Washington, D.C.

(PB81-133829; NBSIR-80-2167) Avail: NTIS HC A05/MF A01 CSCL 13A

The results of a project involving the collection and tabulation of field data on the costs of retrofitting low income houses for energy conservation are presented. The program involves the installation and evaluation of a broad range of energy conservation techniques for over 200 single family houses in 14 demonstration sites throughout the United States. GRA

N81-21250# California Univ., Berkeley. Earthquake Engineering Research Center.

STUDY OF X-BRACED STEEL FRAME STRUCTURES UNDER EARTHQUAKE SIMULATION

Yusof Ghanaat Apr. 1980 243 p refs

(Grant NSF PFR-79-08257)

(PB81-122335; UCB/EERC-80/08; NSF/RA-800194) Avail: NTIS HC A11/MF A01 CSCL 13M

Experimental shaking table test results on the seismic performance of a model three-story building frame, both unbraced and with three different wind bracing systems are presented and correlated with analytical predictions. Considerable compression buckling and tension yielding of the diagonal bracing members were observed in the tests, but the bracing provided significant reductions in the lateral displacements when compared with the unbraced frame response. Analytical techniques employing three different hysteresis models to represent the three types of bracing systems are shown to predict the response of braced frames with excellent accuracy. Analytical response predictions for the unbraced frame, employing concentrated bilinear plastic hinges for all members including joint connections, also are shown to be very accurate for the levels of nonlinearity encountered. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-21251*# SRI International Corp., Menlo Park, Calif.

A TACTILE-OUTPUT PAGING COMMUNICATION SYSTEM FOR THE DEAF-BLIND

James A. Baer Dec. 1979 71 p refs

(Contract NAS2-8711)

(NASA-CR-152332) Avail: NTIS HC A04/MF A01 CSCL 17B

A radio frequency paging communication system that has coded vibrotactile outputs suitable for use by deaf-blind people was developed. In concept, the system consists of a base station transmitting and receiving unit and many on-body transmitting and receiving units. The completed system has seven operating modes: fire alarm; time signal; repeated single character Morse code; manual Morse code; emergency aid request; operational status test; and message acknowledge. The on-body units can be addressed in three ways: all units; a group of units; or an individual unit. All the functions developed were integrated into a single package that can be worn on the user's wrist. The control portion of the on-body unit is implemented by a microcomputer. The microcomputer is packaged in a custom-designed hybrid circuit to reduce its physical size. J.M.S.

N81-21252# Hazeltine Corp., Greenlawn, N. Y.

INTERACTIVE COMMUNICATIONS SYSTEMS SIMULATION MODEL (ICSSM) Final Technical Report, Jul. 1978 - Apr. 1980

Joseph Paolicelli and William F. Griese Dec. 1980 153 p refs

(Contract F30602-78-C-0197; AF Proj. 4519)

(AD-A096054; RADC-TR-80-373; Rept-6410) Avail: NTIS HC A08/MF A01 CSCL 17/2

The Interactive Communication Systems Simulation Model (ICSSM) developed for Rome Air Development Center is capable of simulating a point-to-point communication system including its functional elements, components, propagation effects, and transmission media. The ICSSM is a flexible, expandable, sophisticated and easy-to-use computerized means to develop or configure communication system specific simulation models: specify and validate system requirements; evaluate new techniques and assess the performance of existing and proposed conventional and ECCM communications systems and equipment. The ICSSM's preconfigured programming structure frees the analyst from the burden of constructing a special simulation framework for each model effort, thus permitting him to concentrate on the model formulation itself. Further, the analyst may benefit from the legacy of previous modeling via the ICSSM library of communication model elements which are supported by computerized tutorials and guides. The development of the initial ICSSM concentrated on efficient system structure, a generalized simulation capability and on making the system easy to use. The ICSSM increases in utility with continued use as additional modeling elements are incorporated in the expandable library. GRA

N81-21253# CNR, Inc., Newton, Mass.

WIDEBAND HF CHANNEL ANALYZER Final Technical Report, Mar. 1979 - Jan. 1981

George E. Peo and Phillip A. Bello Jan. 1981 56 p refs

(Contract N00173-79-C-0090; CNR Proj. 58)

(AD-A096224) Avail: NTIS HC A04/MF A01 CSCL 14/2

This document is a final report describing a wideband (1 MHz) HF channel analyzer. The Wideband HF Channel Analyzer is a digital signal processor designed to be used for wideband high-frequency radio channel measurement studies. The analyzer contains analog-to-digital converters, a digital pre-processor, a digital correlator array, a digital post-processor and two computer interfaces. To perform a channel measurement experiment, a transmitter at a remote site broadcasts a pseudo-random number (PN) sequence modulated onto a suitable carrier. After complex demodulation at the receiver, the analyzer measures channel delay by correlating the received sequence with its internal reference. Two modes of operation are provided. The Sounder Mode is used to obtain a preliminary characterization of the channel. The Prober Mode is used to more accurately measure the channel delay characteristics. GRA

N81-21254# Communications Research Centre, Ottawa (Ontario). Radar and Communications Technology Branch.

A THEORY OF SQUINTED SYNTHETIC-APERATURE RADAR

M. R. Vant and G. E. Haslam Nov. 1980 40 p refs Sponsored in part by the Canadian Dept. of National Defense.

(AD-A096262; CRC-1339) Avail: NTIS HC A03/MF A01 CSCL 17/9

A theory is developed that describes the processing of data collected with a satelliteborne or airborne synthetic aperture radar (SAR). A description of the target radar geometry, and the form of the received, demodulated radar signal is given. It is shown that the solution for the case in which the antenna is directed perpendicular to track (sidelooking), is obtained by a simplification of the general case in which the antenna is squinted with respect to the perpendicular to track. A mathematical description of the signal processing operations required to produce a SAR image from the received radar signal is presented and the form of the processed signal is described. In particular, a technique which

employs two dimensional matched filtering to produce the radar image is discussed and the ability of this approach to accommodate the coupling of the range (across-track) and azimuth (along-track) signals is investigated. In addition, the extensions to the theory required for noncoherent averaging are included. GRA

N81-21255# Army Communications Research and Development Command, Fort Monmouth, N. J. Center for Communications Systems.

DIFFRACTION OF MILLIMETER WAVE COMMUNICATION SIGNALS INTO SHADOW REGIONS

N. Rokkos and R. A. Johnson Feb. 1981 19 p

(AD-A096257; CORADCOM-81-1) Avail: NTIS HC A02/MF A01 CSCL 20/14

A study was conducted to determine the order of magnitude of edge diffraction effects at mm-wavelengths. Theoretical and experimental results were found to be in good agreement; both show, however, that the shadow boundary of mm-waves is well defined and that distances by which a mm-wave receiver may be moved into the shadow zone are limited. GRA

N81-21256# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.

AN H-FIELD SOLUTION FOR A CONDUCTING BODY OF REVOLUTION

Joseph R. Mautz and Roger F. Harrington Nov. 1980 92 p refs

(Contract F30602-79-C-0011; AF Proj. 2338)

(AD-A096313; RADC-TR-80-362) Avail: NTIS HC A05/MF A01 CSCL 20/3

The magnetic field integral equation for electromagnetic scattering from a perfectly conducting body of revolution is solved by the method of moments. A Fourier series in theta is used. The t dependence of the expansion functions is subsectional. Pulses are used for the theta component of the unknown electric current induced on the surface S of the body of revolution. Triangles divided by the cylindrical coordinate radius are used for the t component. Here, t and theta are orthogonal coordinates on S, t being the arc length along the generating curve of S and theta the azimuthal angle. A numerical solution is obtained by means of a computer program which is described and listed. This computer program is designed to handle oblique plane wave incidence efficiently. GRA

N81-21257# Air Force Weapons Lab., Kirtland AFB, N. Mex.

ELECTROMAGNETIC PULSE SENSOR AND SIMULATION NOTES - EMP-1-27 Final Report

May 1980 451 p refs

(AF Proj. 9996)

(AD-A096097; AD-E200522; AFWL-TR-80-401) Avail: NTIS HC A20/MF A01 CSCL 20/4

This is a series of ten notes on electromagnetic pulse sensors and simulation. Subjects covered in this volume are: A Study of Waveguide Mode Excitation and Propagation in a Parallel Plate Transmission Line; EMP Simulation and Its Impact on EMP Testing; Electromagnetic Considerations of a Spatial Modal Filter for Suppression of Non-TEM Modes in the Transmission-Line Type of EMP Simulators; An Investigation of Portable EMP Simulators/Alternate Simulators; Electromagnetic Surface Wave Propagation Over a Rectangular Bonded Wire Mesh; Electromagnetic Wave Propagation Along a Pair of Rectangular Bonded Wire Meshes; Surface Wave Propagation on a Rectangular Bonded Wire Mesh Located Over the Ground; Equivalent Electromagnetic Properties of a Concentric Wire Cage as Compared to a Circular Cylinder; Source Excitation of an Open, Parallel-Plate Waveguide; Source Excitation of an Open, Parallel-Plate Waveguide, Numerical Results. GRA

N81-21258# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

RADAR IMAGE INTERPRETABILITY ANALYSIS Final Report, 1 May 1977 - 7 Apr. 1980

V. S. Frost, J. A. Stiles, and J. C. Holtzman Jan. 1981 102 p refs

(Grant DAAG29-77-G-0075)

(AD-A096025; CRINC-RSL-TR-343-2; ARO-14043.11-GS) Avail: NTIS HC A06/MF A01 CSCL 17/9

The utility of radar images with respect to trained image interpreter ability to identify, classify and detect specific terrain features (linear, natural area, complex area features, and individual man-made features) was qualitatively determined. Further, radar images were evaluated with respect to their utility for determining vehicle movement potential and the level of activity within the test areas. Because there are no physical laws governing the relationship between image quality and measurable image characteristics, signal-to-noise ratio, dynamic range, image bandwidth, geometric fidelity and root-mean-square error, a second order linear statistical model was assumed. An experiment was designed and conducted to estimate the coefficients of the model given each image application. The result of this analysis was that statistically significant models were obtained to relate the measured image properties to the interpreters: ability to analyze linear features and to evaluate the utility of radar images for vehicle movement potential and activity level. Further, it was found that the relative importance of the measured image properties with respect to image utility changed with image application. This study has provided useful information as to how certain image characteristics relate to radar image utility as a function of several image applications. GRA

N81-21259# Lincoln Lab., Mass. Inst. of Tech., Lexington.

***INFORMATION PROCESSING TECHNIQUES PROGRAM.* VOLUME 1: PACKET SPEECH SYSTEMS TECHNOLOGY Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1980**

Clifford J. Weinstein and Peter E. Blankenship 30 Sep. 1980 18 p refs

(Contract F19628-80-C-0002; ARPA Order 3673)

(AD-A096365; ESD-TR-80-228) Avail: NTIS HC A02/MF A01 CSCL 17/2

The current program has two major thrusts: i.e., the development and refinement of practical low-cost, robust, narrowband, and variable-rate speech algorithms and voice terminal structures; and the establishment of an experimental wideband satellite network as a unique facility for the realistic investigation of voice/data networking strategies. This report covers work in the following areas: filter bank vocoder development; design study a high-speed, easily programmable, research-oriented speech processor; design and implementation of compact, modular packet voice terminals and local access area facilities; the design and implementation of a miniconcentrator facility to mediate the flow of local access area traffic onto a wideband channel; and experimental definition and planning for the wideband network. GRA

N81-21260# Pattern Analysis and Recognition Corp., Rome, N. Y.

CO-CHANNEL INTERFERENCE SEPARATION Final Technical Report, Sep. 1979 - Sep. 1980

Robert J. Dick Griffiss AFB, N.Y. RADC Dec. 1980 101 p refs

(Contract F30602-79-C-0278; AF Proj. 7055)

(AD-A096059; PAR-80-57; RADC-TR-80-365) Avail: NTIS HC A06/MF A01 CSCL 09/3

The objective of this effort was to investigate techniques to reduce the signal degradation due to co-channel and adjacent-channel voice-on-voice interference. Sorting and suppression techniques using linear prediction coefficients and an adaptive comb filter were investigated. Limited success was achieved. A procedure for estimating the frequency shift due to mistuning was developed. GRA

N81-21261# Mitre Corp., Bedford, Mass.

TWELVE-CHANNEL FIBER OPTIC VOICE MULTIPLEXER Interim Report

A. P. Peardon Griffiss AFB, N.Y. RADC Jan. 1981 27 p

(Contract F19628-80-C-0001; AF Proj. 4519)

(AD-A095980; WP-22582; RADC-TR-80-392) Avail: NTIS HC A03/MF A01 CSCL 17/2

This paper describes a 12 channel fiber optic remoting system used to remote TACS radios such as the MRC-107/108 Jeep Radio, AN/TSC-60 HF Radio, AN/TRC-87 UHF Radio and AN/TRC-97 Tropo Radio. This system employs two 12 channel FM analog multiplexers (with push to talk capability), a fiber optic laser transmitter, a PIN photodetector receiver and a two-fiber cable. GRA

N81-21262# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DESIGN AND REAL-TIME IMPLEMENTATION OF A ROBUST APC CODER FOR SPEECH TRANSMISSION OVER 16 Kb/s NOISY CHANNELS. VOLUME 1. ALGORITHM DESIGN AND SIMULATION Final Report, Jul. 1979 - Dec. 1980
R. Viswanathan, W. H. Russell, and A. Higgins Dec. 1980 287 p refs
(Contract DCA100-79-C-0037)
(AD-A096091; BBN-4565-Vol-1) Avail: NTIS
HC A13/MF A01 CSCL 17/2

This report describes the design and development of a real-time robust APC speech coder that transmits high-quality speech over a 16 Kb/s channel with fit-error rates of up to 1%. This volume (Vol. 1) describes the development, experimental investigation, and speech-quality optimization of 16 Kb/s adaptive predictive coders. Important among the various topics treated in this report are: extensive investigation of several existing and new methods for coding the APC residual, adaptive spectral shaping of the quantization noise, causes for an effective remedy of the limit-cycle behavior of the quantizer output, different APC configurations, optimization of APC coders for error-free channels and for error-full channels, tradeoff between voice data rate and error-protection data rate, tandeming of the optimized 16 Kb/s APC coder with the 2.4 Kb/s LPC-10 coder, and coder performance in noisy backgrounds typical in offices and in air-borne command post environments. Most impressive of the numerous interesting and useful results described in this report is that the final optimized, robust coder design yields speech quality that degrades only slightly as the bit-error rate is increased from 0% to 1%. GRA

N81-21263# Georgia Inst. of Tech., Atlanta. Electromagnetic Effectiveness Div.
A STUDY OF THE ANALYSIS AND MEASUREMENTS OF THREE DIMENSIONAL ARBITRARILY-SHAPED DIELECTRIC SCATTERERS Final Technical Report, Sep. 1978 - Sep. 1980
Jonnson J. H. Wang and C. Papanicolopulos Griffiss AFB, N.Y. RADC Dec. 1980 120 p refs
(Contract F29628-78-C-0223; AF Proj. 2305)
(AD-A096062; RADC-TR-80-372) Avail: NTIS
HC A06/MF A01 CSCL 20/3

The objective of this program is to conduct theoretical and experimental research to determine the electromagnetic scattering from heterogeneous dielectric bodies as individual bodies and as a cluster of bodies. The discrepancies in the literature regarding the singularity of the electric dyadic Green's functions were resolved and a unified and consistent view is presented. Compact range scattering measurements at 1 GHz were successfully performed to obtain measured data to validate the numerical analyses. Extensive computations were made for a variety of dielectric scatterers, including a one-foot bird at 1 GHz. The agreements between measurement and computation were good except for the resonant sphere, for which the calculated resonant frequencies were shifted by about 20 percent. Various numerical techniques were investigated successfully for implementation in the volume methods to treat symmetrical scatterers through use of symmetric matrices, the use of banded matrices, and virtual memory. A new local-file manipulation technique for handling large matrices has been explored and found to be potentially useful. There has been very little research into the problem of scattering by dielectric objects of complex permittivity. Future research in this area should include the investigation of the surface integral equation technique and the exact solution for the dielectric prolate spheroid. GRA

N81-21264# Ohio State Univ., Columbus. ElectroScience Lab.
ANNULAR SLOTS WITH CARDIOID-TYPE PATTERNS
Koichi Ayabe and B. A. Munk Oct. 1980 79 p refs
(Contract N00014-78-C-0855)
(AD-A096277; ESL-711559-1) Avail: NTIS
HC A05/MF A01 CSCL 09/5

This report considers the radiation pattern from one or more concentric circular loops. The current on each loop is comprised of components of the form sin n(phi). It is shown how directive patterns with one and more nulls can be obtained in particularly a true cardioid pattern. Particular attention is given to the tolerances in order to maintain a reasonable sharp null. GRA

N81-21265# Naval Ocean Systems Center, San Diego, Calif.
APPROXIMATE VLF/LF WAVEGUIDE MODE CONVERSION MODEL. COMPUTER APPLICATIONS: FASTMC AND BUMP Progress Report, Oct. 1979 - Sep. 1980
J. A. Ferguson and F. P. Snyder 18 Nov. 1980 107 p refs
(AD-A096240; NOSC/TD-400) Avail: NTIS
HC A06/MF A01 CSCL 20/14

This document reviews vlf radio propagation theory, discusses transequatorial vlf propagation at night and during day-night transitions, and presents a vlf propagation model that includes consideration of inhomogeneities both in the vertical direction and along the propagation path. The model considers anisotropic effects (caused by the geomagnetic field). It is implemented into a FORTRAN computer program called FASTMC. This program allows for an arbitrarily oriented and elevated transmitting dipole antenna from which the vertical or horizontal electric field at an arbitrary elevation can be output. GRA

N81-21266# Naval Ocean Systems Center, San Diego, Calif.
LF DAYTIME EARTH IONOSPHERE WAVEGUIDE CALCULATIONS Interim Report, 1 Jun. 1980 - 1 Jan. 1981
R. A. Pappert Jan. 1981 62 p refs
(DNA-MIPR-81-504)
(AD-A096098; NOSC/TR-647) Avail: NTIS
HC A04/MF A01 CSCL 20/14

This report presents results based on waveguide formalism of a numerical study of daytime propagation in the low frequency (lf) band (30-300 kHz). Results are presented for the vertical electric field produced by vertical electric dipole excitation. Ground-to-ground, air-to-air, ground-to-air, and air-to-ground configurations are considered. The results point out the severity of multipath fading, even under daytime conditions, for the upper lf band. The results should be particularly useful as a basis against which to compare the results of alternative methods. Minor waveguide modifications which allow for treatment of whispering gallery type modes are discussed. For the prototype ionosphere considered in this study there is no (low loss) mode of propagation of the latter type. GRA

N81-21267# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DESIGN AND REAL-TIME IMPLEMENTATION OF A ROBUST APC CODER FOR SPEECH TRANSMISSION OVER 16 Kb/s NOISY CHANNELS. VOLUME 2: REAL-TIME IMPLEMENTATION Final Report, Jul. 1979 - Dec. 1980
J. J. Wolf, K. D. Field, and W. H. Russell Dec. 1980 427 p refs
(Contract DCA100-79-C-0037)
(AD-A096092; BBN-4565-Vol-2) Avail: NTIS
HC A19/MF A01 CSCL 17/2

The implementation of an optimized adaptive predictive coding algorithm as a full time duplex real time speech coder on the CSP MAP-300 array processing computer is described. The program is documented and complete listings of the real-time coder program are included. GRA

N81-21268# Technische Universitaet, Brunswick (West Germany). Inst. fuer Elektrische Maschinen, Antriebz und Bahnen.
FEASIBILITY ASSESSMENT OF A MAGNETICALLY SUSPENDED REACTION/MOMENTUM SPHERE
H. Weh, M. Shalaby, M. May, and M. Marinescu Paris ESA Jan. 1980 149 p refs
(Contract ESA-3635/78/NL-AK)
(ESA-CR(P)-1378) Avail: NTIS HC A07/MF A01

The design of reaction and momentum spheres, including all the suitable possibilities allowed by the current state of magnet suspension and propulsion technology was investigated. Particular emphasis was given to repulsive and attractive suspension methods. Hysteresis and induction motors were examined as a method of propulsion. The control properties of a hysteresis motor did not permit continuous thrust regulation. The design of combined thrust/suspension systems was therefore restricted to the repulsive support concept. The design optimization of support and thrust methods in the attractive system led to a total mass of 11 kg. The installed total power amounted to 0.5 kVA. The

mass of the repulsive system was about 13.8 kg and the total control unit power amounted to 1.05 kVA. The power consumption of the combined repulsive system was 16.2 W as compared with (22.4 + 2.5 W) for the attractive arrangement under given operational conditions. From a technological point of view the repulsive suspension concept is shown less difficult to implement. Author (ESA)

N81-21269# Royal Aircraft Establishment, Farnborough (England).

A PROOF OF EXISTENCE OF A UNIQUE SOLUTION TO THE PROBLEM OF ADAPTIVE BEAMFORMING SUBJECT TO LINEAR CONSTRAINTS

M. F. C. Woollett London HMSO Jun. 1980 16 p refs (RAE-TM-RAD-NAV-135; BR74991) Avail: NTIS HC A02/MF A01

Adaptive beamforming in the presence of linear constraints is described. It is proved that if the number of constraints does not exceed a stated maximum then the adaptive process determines one unique beam pattern. The proof is first written out explicitly using elementary algebra, and secondly in matrix form. The matrix form has the advantage of compactness and makes possible the writing of a simple formula for the weights which themselves define the beam pattern. Author (ESA)

N81-21270# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabteilung Raumfahrtprogramme.

INTEGRATION OF A TERRESTRIAL COMMUNICATIONS NETWORK INTO A COMMUNICATIONS SATELLITE SYSTEM Final Report

Hans Loehle Bonn Bundesministerium fuer Forschung und Technology Jul. 1980 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technology

(BMFT-FB-W-80-002; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

Cost and technical considerations of a terrestrial telephone and television network and its integration into a geostationary satellite network were studied. A simulation was performed with FORTRAN programs. The user is able to decide what services are required (telephone and/or television). A communications model simulates inter-terminal exchanges for telephone communications. Transmission originating from a single television center is relayed via satellite to the different TV participants. Various layouts and optimization considerations are discussed. Author (ESA)

N81-21271# Fondazione Ugo Bordoni, Rome (Italy).

RECENT RESEARCH DEVELOPMENTS IN FREQUENCY SHIFT KEYING SYSTEMS [RECENTI SVILUPPI DELLE RICERCHE SUI SISTEMI FSK]

Giorgio Corazza (Bologna Univ.) Mar. 1980 19 p refs In ITALIAN

(FUB-12-1980) Avail: NTIS HC A02/MF A01

A continuous phase frequency shift keying system (FSK) was studied. It is characterized by the use of a discriminator for demodulation with rectangular modulation pulses of less than a given time duration. A reduction in transmitting power was the main objective, because it limits the application of FSK. It is shown that by proper choice of the pulse duration a power reduction of up to 6 db is obtained. It is concluded that the improvement is greater for narrow bandwidths, and that this system is suitable for multilevel transmission. Author (ESA)

N81-21272# GEC-Marconi Electronics Ltd., Chelmsford (England). Reasrch Lab.

SAR PROCESSOR DEFINITION STUDY EXTENSION. VOLUME 1: TECHNICAL DESCRIPTION OF HARDWARE Final Report

A. B. E. Ellis, A. R. Beasley, and E. A. Jones Paris ESA 5 May 1978 268 p refs 3 Vol.

(Contract ESA-3349/77/NL-HP(SC))

(ESA-CR(P)-1384-Vol-1) Avail: NTIS HC A12/MF A01

A SEASAT-A synthetic aperature radar (SAR) ground processor was studied. The practical hardware solution to the problem is presented. Basically, three main processes are defined: range compression, azimuth compression, and postprocessing which is termed pixel correction. Hardware implementation for the processor is described. The processing method is then discussed, and limitations imposed on the subassemblies by timing problems and storage device capacity are pointed out. A timing scheme for the throughput of processed data is derived. The usefulness of the system is demonstrated by an analysis of the predicted reliability, and the flexibility of the system is indicated. Author (ESA)

N81-21273# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Lab.

SAR PROCESSOR DEFINITION STUDY EXTENSION. VOLUME 2: THEORETICAL DESCRIPTION OF PROCESSING Final Report

S. R. Brooks, P. F. Miller, and A. Luscombe Paris ESA 12 May 1978 293 p refs 3 Vol.

(Contract ESA-3349/77/NL-HP(SC))

(ESA-CR(P)-1384-Vol-2) Avail: NTIS HC A13/MF A01

Theoretical aspects of the processing requirements for a ground based processor which handles synthetic aperture radar (SAR) data from the SEASAT-A satellite were studied. Main processor operations are : (1) pulse (range) compression of the return signal, (2) compression of the return signal in azimuth for the formation of the synthetic aperture, and, as a supplementary operation to (2), correction for range walk of the target return signal during the period of formation of the synthetic aperture. Given the context of the SEASAT-A SAR problem, a system analysis is presented; the processor operations are expressed analytically. Computer simulation to test the validity of the processing method, specifically reordering in the frequency domain, is described. Digital processing aspects are brought out, and the compression algorithms are defined. Author (ESA)

N81-21274# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Lab.

SAR PROCESSOR DEFINITION STUDY EXTENSION. VOLUME 3: SPECIFICATION Final Report

A. B. E. Ellis and S. R. Brooks Paris ESA 5 May 1978 137 p refs 3 Vol.

(Contract ESA-3349/77/NL-HP(SC))

(ESA-CR(P)-1384-Vol-3) Avail: NTIS HC A07/MF A01

Equipment specification for a ground based processor which handles synthetic aperture radar (SAR) data from the SEASAT-A satellite is presented. Equipment which performs six main tasks is defined. The tasks are: (1) interface with a high density digital tape playback recorder, providing SAR and auxiliary data for processing as well as producing computer compatible data tapes; (2) carry out range compression of this data and produce computer compatible tapes; (3) carry out azimuth compression of the data; (4) reduce image speckle by multilooks at the targets; (5) provide an output of the processed data; and (6) accept from an external source the data to be processed, annotate the data, and provide overall control of the system operation. Hardware mechanical and technical characteristics are described. The software for the PDP 11 based system is detailed. Processing performance specifications are set. The acceptance testing test philosophy is outlined. Author (ESA)

N81-21275# Fondazione Ugo Bordoni, Rome (Italy).

THEORY OF INFORMATION RATE DISTORTION AND ITS APPLICATIONS [TEORIA DELLA DISTORSIONE DI TASSO INFORMATIVO E SUE APPLICAZIONI]

Guido DiBlasio (Rome Univ.) Oct. 1980 132 p refs In ITALIAN

(FUB-19-1980) Avail: NTIS HC A07/MF A01

The theory of the distortion of information rate is presented, and related to the more general problem of optimization of communication systems. The differences with Shannon's theory of channel coding are pointed out. The communication characteristics of transmitter, channel and receiver are described, and the matching and coding problems are analyzed. The distortion functions were studied for both continuous and discrete sources, considering in detail coding for a continuous source. Some applications of the theory are discussed. Author (ESA)

N81-21276# Fondazione Ugo Bordoni, Rome (Italy).

DESCRIPTION AND VALIDATION OF COMMUNICATION PROTOCOLS BY MEANS OF PETRI NETWORKS [DESCRIZIONE E VALIDAZIONE DI PROTOCOLLI DI COMU-

NICAZIONE MEDIANTE LE RETI DI PETRI]
Nicola Accarino, Claudio Rossi, and Sebastiano Trigila Aug. 1980 86 p refs In ITALIAN
(FUB-21-1980) Avail: NTIS HC A05/MF A01

Petri nets are defined and described. It is shown that models based on Petri networks can describe a set of competing processes showing their interaction modalities. An algorithm for *the analysis of Petri networks is described and implemented.* Several examples illustrate communication processes described by Petri networks. The computer program RETPET which includes *the described algorithm is presented.* Author (ESA)

N81-21277# European Space Agency, Paris (France).
DEVELOPMENT, MANUFACTURE AND TESTING OF A PLANAR-ARRAY L-BAND ANTENNA
Eberhard Frisch, Hans-Friedrich Siegling, and Dieter Fasold Feb. 1981 219 p refs Trans. into ENGLISH of "Entwicklung, Aufbau u. messtech. Untersuchung einer Mikrowellen-Planar-Array-*Antenne im Frequenzbereich L-band" Rept. BMFT-FB-W-77-16* Bundesministerium fuer Forschung und Technologie, Dec. 1977
(ESA-TT-541; BMFT-FB-W-77-16) Avail: NTIS *HC A10/MF A01*

A circularly polarised 1 5 GHz antenna was built and tested for use as an Earth coverage antenna for use on board *geostationary satellites. A rigid foam panel of extremely low* dielectric loss coated with aluminium on the surfaces to give a sandwich effect forms the interior of a TE sub 50 resonator. *The slot pattern is etched on one broadside of the skin.* During development, sandwich and frame construction methods were evaluated, a structural analysis using NASTRAN performed, and tests for tests for dielectric losses of foams made. Foams were also tested for density variations, tensile strength, and outgassing. Thermal control considerations are given. The *rear of the antenna* is covered with superinsulation. Far field measurement tests show maximum gain 19.4 dB; gain at edge of earth 15.2 dB; ellipticity *at edge of Earth 2.5 dB and fundamental resonance 140 Hz.* The reduction in gain due to the foam is less than 0.1 dB.
Author (ESA)

N81-21278# Federal Communications Commission, Washington, D. C. Office of Plans and Policy.
SPEECH BANDWIDTH REDUCTION. (WORKING PAPER)
Philip B. Gieseler and John B. ONeal, Jr. Nov. 1980 41 p refs Prepared in cooperation with North Carolina State Univ., Raleigh
(PB81-128068; FCC/OPP/WP80-03) Avail: NTIS HC A03/MF A01 CSCL 17B

The current state of the art in analog and digital speech bandwidth compression is assessed with a focus on minimizing the bandwidth of the voice signal used for mobile and other voice communication systems. If techniques exist for significantly reducing the 3 kHz bandwidth while maintaining sufficient quality, the radio frequency bandwidth can be proportionately reduced. The status of speech baseband compression is still in the laboratory stage or just emerging. None of it has been applied in any large commercial operation. Hardware implementations exist that provide reasonal intelligibility in about half the normal baseband, but the basic conclusion of this review is that current techniques for reducing speech bandwidth produce a concomitant degradation in speech quality which would not necessarily be acceptable in all cases. This basic conclusion is amplified, analyzed, and supported in the evidence presented. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N81-21279*# Aerojet Electrosystems Co., Azusa, Calif.
CRYOGENIC SWITCHED MOSFET CHARACTERIZATION
Mar. 1981 35 p refs
(NASA Order A-80598-B)
(NASA-CR-166164; Rept-7165) *Avail: NTIS*
HC A03/MF A01 CSCL 09C

Both p channel and n channel enhancement mode MOSFETs *can be readily switched on and off at temperatures as low as* 2.8 K so that switch sampled readout of a VLWIR Ge:Ga focal plane is electronically possible. Noise levels as low as 100 *rms electrons per sample (independent of sample rate) can be achieved* using existing p channel MOSFETs, at overall rates up to 30,000 *samples/second per multiplexed channel (e.g., 32* detectors at a rate of almost 1,000 frames/second). Run of the mill devices, including very low power dissipation n channel FETs *would still permit noise levels of the order of 500 electrons/* sample. A.R.H.

N81-21280*# *National Aeronautics and Space Administration.* Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE OF PHOTOMULTIPLIER TUBES AND *SODIUM IODIDE SCINTILLATION DETECTOR SYSTEMS*
Charles A. Meegan Mar. 1981 46 p refs
(NASA-TM-82406) Avail: NTIS HC A03/MF A01 CSCL *09C*

The performance of photomultiplier tubes (PMT's) and scintillation detector systems incorporating 50.8 by 1.27 cm NaI *(T l)* crystals was investigated to determine the characteristics of the photomultiplier tubes and optimize the detector geometry for the Burst and Transient Source Experiment on the Gamma Ray Observatory. Background information on performance characteristics of PMT's and NaI (T l) detectors is provided, procedures for measurement of relevant parameters are specified, and results of these measurements are presented. M.G.

N81-21281*# *National Aeronautics and Space Administration.* Lewis Research Center, Cleveland, Ohio.
ELECTRIC VEHICLE MOTORS AND CONTROLLERS
Richard R. Secunde 1981 33 p refs Presented at the 5th Intern. Workshop on Rare Earth: Cobalt Magnets and their Applications, Roanoke, Va., 7-10 Jun. 1981
(Contract DE-AI01-77CS-51044)
(NASA-TM-81760; DOE/NASA/51044-18; E-823) Avail: NTIS HC A03/MF A01 CSCL 09C

Improved and advanced components being developed include electronically commutated permanent magnet motors of both drum and disk configuration, an unconventional brush commutated motor, and ac induction motors and various controllers. Test results on developmental motors, controllers, and combinations thereof indicate that efficiencies of 90% and higher for individual components, and 80% to 90% for motor/controller combinations can be obtained at rated power. The simplicity of the developmental motors and the potential for ultimately low cost electronics indicate that one or more of these approaches to electric vehicle propulsion may eventually displace presently used controllers and brush commutated dc motors. E.D.K.

N81-21282# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
STATISTICS ON VLSI DESIGNS Interim Report
Jon Louis Bentley, Dorothea Haken, and Robert W. Hon 17 Apr. 1980 62 p refs
(Contracts N00014-76-C-0370; F33615-78-C-1551)
(AD-A096377; CMU-CS-80-111) Avail: NTIS HC A04/MF A01 CSCL 09/1

This paper presents a statistical study of the components on VLSI chips. We examine the size and shape of components, and their placement over the chip area. The data is useful for building efficient VLSI design tools: the form of the distribution shows that some simple strategies can lead to efficient algorithms, and the parameters of the distribution aid in choosing program parameters. To illustrate the application of the statistics to VLSI design tasks, we present an algorithm for solving the 'rectangle intersection' problem that arises in design rule checkers. GRA

N81-21283# Carnegie-Mellon Univ., Pittsburgh, Pa.
AREA-EFFICIENT GRAPH LAYOUTS (FOR VLSI) Interim Report
Charles E. Leiserson 13 Aug. 1980 27 p refs
(Contracts N00014-76-C-0370; F33615-78-C-1551; Grant NSF MCS-78-23676; ARPA Order 3597)

(AD-A096367; CMU-CS-80-138) Avail: NTIS
HC A03/MF A01 CSCL 09/5

Minimizing the area of a circuit is an important problem in the domain of Very Large Scale Integration. We use a theoretical VLSI model to reduce this problem to one of laying out a graph, *where the transistors and wires of the circuit are identified with* the vertices and edges of the graph. We give an algorithm that produces VLSI layouts for classes of graphs that have good *separator theorems. We show in particular that any planar graph* of n vertices has an O(n lg-square(n)) area layout and that any tree of n vertices can be laid out in linear area. The algorithm *maintains a sparse representation for layouts that is based on* the well-known UNION-FIND data structure, and as a result, the running time devoted to management of this representation *is nearly linear.* GRA

N81-21284# Carnegie-Mellon Univ., Pittsburgh, Pa. *Dept. of* Computer Science.

A LAYOUT FOR THE SHUFFLE-EXCHANGE NETWORK
Interim Report

Dan Hoey and Charles E. Leiserson 18 Aug. 1980 19 p refs
(Contracts N00014-76-C-0370; N00014-80-C-0236;
F33615-78-C-1551; Grant NSF MCS-78-23676)
(AD-A096368; CMU-CS-80-139) Avail: NTIS
HC A02/MF A01 CSCL 09/5

This paper describes a technique for producing a VLSI layout of the shuffle-exchange graph. It is based on the layout procedure which lays out a graph by bisecting the graph, recursively laying *out the two halves, and then combining the two sublayouts.* The area of the layout is related to the number of edges that must be cut to bisect the graph. For the *shuffle-exchange graph* on n vertices, we present a bisection schema for which the above procedure yields an O(n-squared/lg n) area layout when n = 2 to the K *power and k is a power of two. The bisection* involves a mapping from vertices of the graph to polynomials, and the polynomials are subsequently evaluated at complex roots *of unity. Incidental to this construction is a result on the* combinatorial problem of necklace enumeration. GRA

N81-21285# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

SPECIAL-PURPOSE DEVICES FOR SIGNAL AND IMAGE PROCESSING: AN OPPORTUNITY IN VLSI Interim Report

Hsing-Tsung Kung Jul. 1980 12 p *refs*
(Contracts N00014-76-C-0370; N00014-80-C-0236;
F33615-78-C-1551; Grant NSF MCS-78-23676)
(AD-A096366; CMU-CS-80-132) Avail: NTIS
HC A02/MF A01 CSCL 09/5

Based on the systolic array approach, new designs of special-purpose devices for filtering, correlation, convolution, and discrete Fourier transform are proposed and discussed. It is argued that because of high degrees of simplicity, regularity and concurrency inherent to these designs, their VLSI implementation will be cost effective. GRA

N81-21286# Colorado State Univ., Fort Collins. Dept. of Physics.

ELECTRONIC PROPERTIES OF 3-5 SEMICONDUCTOR INTERFACES Final Report, Jun. 1976 - Sep. 1980

James R. Sites 30 Nov. 1980 28 p *refs*
(RR0210203; NR Proj. 243-015)
(AD-A096225; SF29) Avail: NTIS HC A03/MF A01 CSCL 20/12

Final contract year dealt with dc transport in InP and GaAs device structures at low temperatures and high magnetic fields. Primary emphasis was on the mobility profile in field effect transistors, with secondary emphasis on basic bulk transport mechanisms. In previous years, studies were made of GaAs MIS structures, encapsulation of GaAs for annealing, and electronic profiling of InAs layers. GRA

N81-21287# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.

TABLES OF DESIGNS FOR N-WAY IN-PHASE POWER DIVIDERS/COMBINERS

Russell A. Gilson and Robert A. Weck Dec. 1980 23 p
(DA Proj. 1L1-62705-AH-94)
(AD-A096029; DELET-TR-80-21) Avail: NTIS
HC A02/MF A01 CSCL 09/1

This report describes the design and resulting performance of an N-way in-phase power divider/combiner that was first devised and described by U. Gysel. Since closed form solutions for the transmission line elements do not exist, computer aided design and optimization were used to generate design tables for 2 to 8 way divider/combiners with up to 50 percent bandwidths. The design tables along with a CAD program listing *are presented.* GRA

N81-21288# ARO, Inc., Arnold Air Force Station, Tenn.

COMPUTER CONTROLLED LIFE TESTING OF LIGHT-EMITTING DIODES (LED'S) Final Report, Jan. 1976 - Dec. 1979

A. E. Lennert and J. B. Puckett AEDC Feb. 1981 131 p refs Sponsored by AF
(AD-A095921; AEDC-TR-80-25) Avail: NTIS
HC A07/MF A01 CSCL 09/1

An automated, computer-controlled, test complex was designed and built to life test a large number of light-emitting diodes (LED's). One of the objectives of the test was to determine the minimum burn-in time required to estimate the lifetime of the LED's. The test setup, experimental hardware, operating details, and the problems that arose during the test program are described. Experimental and theoretical results of attempts to estimate the lifetimes of the devices are presented and discussed. It was found that if the light output power degraded by more than 15 percent of the initial light output power and if *there was a voltage change exhibited by the LED's of more* than 100 mv, within a period of 200 hr, then the light output power of the LED's would fall below 50 percent of the original light output power within 2,000 hr of operation. The initial degradation rate was found to be proportional to the operating temperature and current density, whereas the degradation rate of those devices that passed the screening criteria appeared to be independent of these parameters after 2,000 hr of operation. The double-heterojunction devices had a longer mean time to failure than did the homojunction devices. The time to obtain 50 percent of the initial light output power was used as a criterion of failure. GRA

N81-21289# Lehigh Univ., Bethlehem, Pa.

TESTABILITY AND RELIABILITY OF LSI Final Technical Report, 15 Sep. 1978 - 31 Jul. 1980

Alfred K. Susskind Griffiss AFB, N.Y. RADC Jan. 1981 128 p *refs*
(Contract F30602-78-C-0292)
(AD-A096310; RADC-TR-80-384) Avail: NTIS
HC A07/MF A01 CSCL 09/1

A number of studies related to testing, testability, and reliability were made and the major results are reported. One study was concerned with the relationship between testing and reliability, which lies in the lack of dependability caused by incomplete testing. An approach to calculating this lack of assurance, based on binary decision diagrams, was formulated and programmed. Initial experience with a first version indicates that care must be exercised in optimizing programming, if large networks are to be handled economically. A major part of the report is concerned with an exhaustive form of the 2n different Walsh coefficients, of which two are particularly useful. The first is just the conventional counting of the number of ones in the response. The second is shown to detect any pin faults, in any combination, with a particularly simple test-equipment implementation that may well serve as a BIT (built-in-test) design. The application of Walsh-coefficient verification to array logic is investigated. Simple PLA's are shown to be readily testable; arrays with flip-flops are also studied and methods for improving their testability are given. The formulation of a testability measure (TM) is described. The TM is calculated on the basis of a gate-level network description. The actual calculations are based on approximations, but their validity can be verified by precise calculations. When the approximations are used, the task of evaluating the testability is much less than finding actual tests. GRA

N81-21290# Stanford Univ., Calif. Dept. of Computer Science.

DATABASE APPROACH TO COMMUNICATION IN VLSI DESIGN
Gio Wiederhold, Anne Beetem, and Garrett Short Oct. 1980 15 p refs
(Contract N00039-80-C-0132; ARPA Order 3889)
(AD-A096347; SU-STAN-CS-80-826) Avail: NTIS HC A02/MF A01 CSCL 09/5

This paper describes recent and planned work at Stanford in applying database technology to the problems of VLSI design. In particular, it addresses the issue of communication within a design's different representations and hierarchical levels in a multiple designer environment. We demonstrate the heretofore questioned utility of using commercial database systems, at least while developing a versatile, flexible, and generally efficient model and its associated communication paths. Completed work and results from initial work using DEC DBMS 20 is presented, including macro expansion within the database, and signalling of changes to higher structural levels. Considerable discussion regarding overall philosophy for continued work is also included. GRA

N81-21291# Naval Air Engineering Center, Lakehurst, N.J. Handling and Servicing/Armament Div.
NICKEL-CADMIUM BATTERY CHARGER Interim Report, Oct. 1978 - Oct. 1980
Richard F. ODonnell 23 Feb. 1981 17 p refs
(WF41461400)
(AD-A096318; NAEC-92-145) Avail: NTIS HC A02/MF A01 CSCL 10/3

This report contains information relevant to the support of mini nickel-cadmium batteries (0 to 5 Amp-hr) utilized in the Fleet. Initial reports indicated that these batteries were not supported by an approved charger/analyzer. A thorough investigation of this allegation concluded that all complaints concerning the lack of support of these batteries have been corrected and no documentation has been found to indicate otherwise. It was also determined that pulse charging warrants further investigation as a possible charging technique to be applied to these batteries. GRA

N81-21292# Naval Research Lab., Washington, D. C.
ANALYSIS OF THE WIDE BAND GYROTRON AMPLIFIER IN A DIELECTRIC LOADED WAVEGUIDE Interim Report
J. Choe, H. Uhm, and S. Ahn 10 Mar. 1981 34 p refs
(AD-A095954; NRL-MR-4460) Avail: NTIS HC A03/MF A01 CSCL 09/1

The effect of broadening the bandwidth with a dielectric load in a cylindrical gyrotron is investigated for a hollow electron beam. The linear dispersion relation for the azimuthally symmetric, transverse electric (TE) modes is obtained by the method of the wave impedance matching. It is found that the TE perturbations exhibit three unstable modes characterized by their phase velocities (v(ph)); one fast wave, the long wavelength mode (LWM, vph=c), and two slow waves, the intermediate (IWM,c=v(ph)=c c/sq root of epsilon) and the short (SWM, v(ph)- c/sq root of epsilon) wavelength modes. The optimum conditions for the wide band operation are obtained individually for each mode. Although the bandwidth in excess of 40% is possible for the slow waves (IWM, SWM). At a small axial momentum spread, it decreases rapidly as the spread increases. On the other hand, the LWM yields approximately 10% of the bandwidth insensitive to the spread. It is also shown that for a small spread (less than 5%), the slow wave (IWM) is preferable for the wide band operation, whereas for a large spread (greater than 5%) the fast wave (LWM) is desirable. GRA

N81-21293# Naval Postgraduate School, Monterey, Calif.
INTERMODULATION PRODUCT SUSCEPTIBILITY TESTING OF MULTICOUPLERS USING WHITE NOISE M.S. Thesis
David William Smith Sep. 1980 87 p refs
(AD-A096303) Avail: NTIS HC A05/MF A01 CSCL 09/1

The problem of intermodulation product susceptibility and its specification in multicouplers is discussed. The two-tone input and white noise loading methods for testing and determining specifications are presented with spectrum displays. An improved method of testing and determining multicoupler intermodulation product susceptibility specifications is presented. GRA

N81-21294# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.
TRAVELING WAVE TUBE FAILURE RATES Final Technical Report, Jun. 1979 - Jul. 1980
J. H. Engleman, J. Kennedy, and S. R. Wood Nov. 1980 35 p refs
(Contract F30602-79-C-0188; AF Proj. 2338)
(AD-A096055; HAC-SCG-00228R; RADC-TR-80-288) Avail: NTIS HC A03/MF A01 CSCL 09/1

A traveling wave tube (TWT) failure rate model is derived. The model gives TWT failure rate as a function of power, frequency, and environment. The data base used to derive the model was obtained from military users of TWTs, TWT manufacturers, and manufacturers of systems containing TWTs. The model is applicable to pulsed and continuous wave TWTs, TWTs used in radar, electronic countermeasures, and communications applications, and all military environments. GRA

N81-21295# Naval Observatory, Washington, D. C. Time Service Div.
EVALUATION OF PREDICTABILITY OF QUARTZ-CRYSTAL OSCILLATORS AND OTHER DEVICES Final Report, Nov. 1978 - Jan. 1981
Laura G. Charron and Randolph T. Clarke, III 15 Jan. 1981 53 p refs
(AFOSR MIPR-HC-1001-8-40079)
(AD-A096380; USNO-TS-1-81) Avail: NTIS HC A04/MF A01 CSCL 09/5

Data were collected over varying intervals for several types of devices (quartz-crystal, rubidium, cesium beam oscillators and hydrogen maser) and compared to NAVOBSY USNO MC. An ARIMA and several polynomial models for prediction purposes were evaluated. It is concluded that very simple prediction methods can suffice in maintaining a timing system. GRA

N81-21296# Texas Instruments, Inc., Dallas.
RELIABILITY EVALUATION OF GaAs FETS Final Technical Report, 7 Nov. 1978 - 7 May 1980
H. M. Macksey Griffiss AFB, N. Y. RADC Jan. 1981 101 p refs
(Contract F30602-79-C-0037; AF Proj. 2338)
(AD-A096306; TI-08-80-32; RADC-TR-80-390) Avail: NTIS HC A06/MF A01 CSCL 09/1

The objective of this program was to assess and establish the reliability and life characteristics of commercially available, medium power GaAs MESFETs and to identify any associated failure mechanisms. The devices chosen for this study were the TI MSX802 and laboratory devices and devices from three other manufacturers, A, B, and C. All devices were hermetically packaged and had approximately 0.5 W output power. The study included device physical, electrical (CW and pulsed), and environmental characterization; electrical (CW and pulsed) and environmental stress tests; and failure analysis. All the tests were completed during the program. During the electrical characterization no device had significant changes in electrical parameters following operation for 1000 hours at room temperature. No devices lost hermeticity or had any significant changes in dc current-voltage characteristics following any of the environmental characterization tests (mechanical and thermal stresses). There were some correlations between the various device structures and the electrical stress test results from those structures. During the environmental stress tests some of the device types did not have sufficient failures in 1000 hours, even with a 215 C heat sink, to derive an activation energy. Others had an activation energy of approximately 1.8 eV and an extrapolated median life of approximately 10 to the 12th power hours at room temperature. Both catastrophic and gradual (1 dB output power degradation) failures were observed; some could be associated with specific failure mechanisms and others could not. GRA

N81-21297# Naval Weapons Support Center, Crane, Ind. Systems Packaging Design Branch.
THE EFFECTS OF REDUCED ATMOSPHERIC PRESSURE ON THERMAL CONTACT RESISTANCE AND ELECTRONIC COMPONENT FORCED AIR FILM COEFFICIENTS
Ronald B. Lannan and Robert Evans 15 Aug. 1980 70 p refs

(Contract N00173-78-C-80021)
(AD-A096254; NWSC/CR/TR/6042/C80/04) Avail: NTIS HC A04/MF A01 CSCL 09/1

This report summarizes the theoretical and empirical analysis performed to determine the effects of reduced atmospheric pressure (for altitudes up to 70,000 feet) on conduction and convection thermal interfaces encountered in unpressurized avionics electronic equipment bays. For the purpose of this report, the conduction thermal interface of the Improved Standard Electronic Module (ISEM) was selected for study, although the empirical results and theoretical approach revealed herein can be applied to similar conduction interfaces on other electronic modules. The results of the effects of reduced atmospheric pressure on forced-air film coefficients can be applied generally to forced-air cooling of most electronic equipment. GRA

N81-21298# New Mexico Univ., Albuquerque. Coll. of Engineering.
VARIABLE SPEED CONSTANT FREQUENCY CONSTANT VOLTAGE ALTERNATOR Annual Report
W. W. Grannemann, C. E. Yang, and P. H. Seo Jul. 1980 41 p refs
(Contract DE-AC01-79ET-29246)
(DOE/ET-29246-T1; EE-266(80)DOE-808-1) Avail: NTIS HC A03/MF A01

A test alternator was operated with digital control of its output frequency for variable shaft speed. The machine is a two pole alternator with power removed through slip rings. The output frequency of the alternator is controlled by rotating the field by stepping through sixteen coils around the rotor. Usually four coils are active at one time. The rotating field in the stationary coils of the stator is controlled by microcircuits. The control circuits are constructed with available low cost, low power integrated circuits (ICS). The test results from the first test alternator indicate the feasibility of using this type of alternator to convert available wind power directly to usable 60 hertz power. DOE

N81-21299# Sandia Labs., Albuquerque, N. Mex. IC Process Development and Control Div.
ACCEPTANCE CRITERIA FOR THICK FILM RESISTORS
T. V. Nordstrom Aug. 1980 29 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1395) Avail: NTIS HC A03/MF A01

The lot to lot consistency of BIROX 1400 series thick film resistors was determined and incoming inspection procedures for links were evaluated. The resistors were found to be very consistent and reproducible. Recommendations are that material be bought on the standard manufacturer certifications. A testing program of ink properties was recommended to establish a material data base. DOE

N81-21300# Sandia Labs., Albuquerque, N. Mex. Ground Motion and Seismic Div.
ERROR SURFACES OF ADAPTIVE RECURSIVE FILTERS
Samuel D. Stearns Feb. 1981 24 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1348) Avail: NTIS HC A02/MF A01

For an adaptive filter with N adjustable coefficients or weights, the error surface is a plot, in N + 1 dimensions, of the mean squared error vs the N coefficient values. If the adaptive filter is nonrecursive, the error surface is a quadratic function of the coefficients. With recursive adaptive filters, the error surface is not quadratic and may even have local minima. The nature of the recursive error surface and the conditions under which local minima may exist are examined using theory and examples. The effects of the nonquadratic error surface on gradient search algorithms for recursive adaptive filters are discussed. E.D.K.

N81-21301# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
PROCUREMENT AND INSPECTION OF ELECTRONIC COMPONENTS USED IN THE SPACEBORNE EXPERIMENT HEAO-C2 [BILAN DES COMPOSANTS ELECTRONIQUES UTILISES DANS L'EXPERIENCE EMBARQUEE - HEAO C2]
F. Linder Jan. 1979 25 p In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-696)
(CNES-QPE/FT/006) Avail: NTIS HC A02/MF A01

The parts policy and procurement results for the High Energy Astronomy Observatory experiment C2 (HEAO-C2) are reported on. The HEAO-C2 measures the isotopic composition of the most abundant elements in the cosmic ray range between beryllium and iron up to nucleon energies of 15 GeV. Information concerning parts lists, specifications, procurement (delivery delays, costs), and acceptance testing as well as test results are provided. Standards of quality are cited, and choice of manufacturer is discussed. Debugging, derating, construction analysis, scanning electron microscopy analysis, and destructive physical analysis are commented on. Inspection test results demonstrate the impact of quality control on equipment reliability. Author (ESA)

N81-21302# AEG-Telefunken, Ulm (West Germany). Grundlagenentwicklung.
THE 64/4 GHz DOWN CONVERTER USED FOR A 60 GHz TRANSPONDER SYSTEM Final Report
Helmut Barth, Michael Bischoff, and Joerg Schroth Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 122 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-21; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

A low noise 64 to 4 GHz down converter was developed for 60 GHz transponder system. Linear and nonlinear theory of oscillators were reviewed, and the Q factor of an oscillator was examined. Oscillator equivalent circuits were built and examined, showing good agreement between numerical results and measurement. Test local oscillators were then fabricated and characterized. The signal and local oscillator power were combined by a directional filter giving a transmission loss of 3.2 dB and an isolation of 22 dB at 60 GHz. The conversion loss for the series resistance of the mixer diodes was calculated. The mixer excluding the directional filter is shown to have a conversion loss of 4.8 dB at a local oscillator power of 13.8 dBm.
Author (ESA)

N81-21303# Siemens A.G., Munich (West Germany). Bereich Weitverkehrstechnik.
DEVELOPMENT OF A THERMOELECTRICALLY COOLED PARAMETRIC AMPLIFIER FOR GROUND STATION APPLICATIONS AT 10.95 TO 11.8 GHz Final Report
Michael Niemeyer, Horst Jessel, and Ronald J. Tepereck Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 116 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-26; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

A prototype model of an amplifier system for satellite ground station applications in the superhigh frequency range was fabricated. For the design concept, high reliability, gain stability, ease in operation and maintenance as well as a broad bandwidth and low noise characteristics were investigated. The basic model of the amplifier unit consisted of a two stage, parametric amplifier. The first stage was cooled to 258 K, while the second was a field effect transistor post amplifier. The parametric amplifier stages were pumped at 51.5 GHz with the aid of Gunn oscillators. All assemblies were mounted in a hermetically tight thermostat enclosure and were rigorously temperature stabilized. Electrical measurement results show a frequency range of 10.95 to 11.7 GHz, a bandwidth (-1 dB) ACH-110A or = 750 MHz, a gain of 52 dB, a gain variation ACH-76A or = 1.4 dB(ss), a noise temperature of 140 K max and 120 K mini, and a gain stability over 10 min ACH-76A or = 0.04 dB(ss) and over 24 hr, ACH-76A or = 0.2 dB(ss). Author (ESA)

N81-21304# Siemens A.G., Munich (West Germany). Bereich Weitverkehrstechnik.
SEMICONDUCTOR MICROWAVE POWER AMPLIFIER FOR THE 11 GHz TO 14 GHz FREQUENCY RANGE Final Report
Michael Krefft Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 91 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-28; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

A five stage X-band power amplifier was built. Active

semiconductor devices with negative microwave impedance were used. One BARRITT diode, one Gunn element and three IMPATT diodes were implemented in the five stages which are designed as reflection-type amplifiers with circulators. The amplifier chain was analyzed with respect to performance. Results show a frequency range of 11GHz + or - 400 MHz for a 3 dB bandwidth, a gain of 39 dB, an output power of + 33.5 dBm, and a noise figure of 18 dB. The amplifier chain is supplied by a bias regulating device which ensures damage free operation (on-off switching) and which also serves as a temperature compensating module for the amplifier. Author (ESA)

N81-21305# AEG-Telefunken, Ulm (West Germany). Geschaeftsbereich Roehren und Baugruppen.
LINEARIZATION NETWORK FOR SATELLITE TRAVELING WAVE TUBE Final Report
Thomas Spoether and Harry Thienel Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-29; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

A 4 GHz/13 W traveling wave tube linearizer was developed, aiming at a twofold increase in the linear drive range with respect to AM-AM conversion and phase linearity. This design was realized using an automatic constant gain/phase control circuit. The AM-FM linearization network is an electronic, controlled attenuator with PIN diodes while the tube phase linearization network makes use of a variable varactor diode phase shifter. The AM-AM linearizer realized improves the linear drive range by 3 dB while the phase linearizer reduces the phase shift by 50%.
Author (ESA)

N81-21306# Fondazione Ugo Bordoni, Rome (Italy).
PERFORMANCE ANALYSIS OF THE METACONTA-L COMMUTATION SYSTEM: PROBLEMS AND METHODS
Pietro Cecilia, Davide Grillo, and Walter Podda Jan. 1980 60 p refs In ITALIAN
(FUB-11-1980) Avail: NTIS HC A04/MF A01

The system, which is in operation, and its performance are described. The architecture of the system and the control unit, and the organization of the software are detailed. The operating mode and the control intervention for a typical call are illustrated. The concepts and indexes used to describe and autocommutator performance are presented. The statistics of actual performance are summarized. Author (ESA)

N81-21307# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
CASCADABLE MONOLITHIC BALANCED AMPLIFIERS AT MICROWAVE FREQUENCIES
E. M. Bastida, G. P. Donzelli, and N. Fanelli 1980 8 p refs Presented at 10th European Microwave Conf., Warsaw, 8-12 Sep. 1980
(CISE-1595) Avail: NTIS HC A02/MF A01

A cascadable monolithic amplifier, where input-output decoupling is obtained through broad band, low loss coplanar directional couplers, is described. Design data and experimental results are given for the couplers which are suitable for both hybrid and monolithic circuit applications. For the amplifier, a single point matching technique was sufficient to obtain a flat gain over the selected bandwidth. Matching at the upper frequency limit is achieved through series and parallel inductances. The latter ones, dc insulated from ground by 0.4 micron thick SiO2 MIM capacitors, were used as biasing networks. A 0.8 micron gate self aligned field effect transistor was employed as an active device, which allowed 10 dB gain to be obtained from 9 to 11 GHz. The simplicity of matching circuits allowed single stage minor akjustments from wafer to wafer, which were found unnecessary when correlated to a proper dc device characterization. Passive circuit metallization was 3 micron thick electrolytic gold directly grown on the first Au Ge layer, obtained by the liftoff process. Author (ESA)

N81-21308# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.
CONSTRUCTION AND PROPERTIES OF A QUADRUPOLE MASS SPECTROMETER DEVICE, DEVELOPED FOR THE INVESTIGATION OF A THERMIONIC BARIUM-CESIUM-DIODE VAPOR ATMOSPHERE Ph.D. Thesis - Stuttgart Univ.
Dieter Mahr Mar. 1979 110 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-701)
(DFVLR-FB-79-39) Avail: NTIS HC A06/MF A01

Construction and operation characteristics of a thermionic converter, incorporating a measurement system which measures diode power output and simultaneously spectrographically analyzes the mixed vapor Ba Cs atmosphere of the thermionic diode are described. Results of measurement analysis of current voltage characteristics of the diode and of respective vapor phase, gas composition in the diode quantitatively show the reciprocal action of the vapor components in a mixed vapor system. Using this data, the atmospheric composition for optimum performance in terms of power output of the thermionic diode can be calculated. Author (ESA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N81-21309*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
ON THE PRESSURE FIELD OF NONLINEAR STANDING WATER WAVES
Leonard W. Schwartz May 1980 20 p refs
(Contract NCC2-55)
(NASA-CR-164181; SU-JIAA-TR-33) Avail: NTIS HC A02/MF A01 CSCL 20D

The pressure field produced by two dimensional nonlinear time and space periodic standing waves was calculated as a series expansion in the wave height. The high order series was summed by the use of Pade approximants. Calculations included the pressure variation at great depth, which was considered to be a likely cause of microseismic activity, and the pressure distribution on a vertical barrier or breakwater. R.C.T.

N81-21310*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACCELERATION WAVE BREAKUP OF LIQUID JETS WITH AIRSTREAMS
Robert D. Ingebo 1981 10 p refs Proposed for presentation at the Symp. on Fluid Mech., Boulder, Colo., 22-24 Jun. 1981; sponsored by ASME
(NASA-TM-81717; E-750) Avail: NTIS HC A02/MF A01 CSCL 20D

Characteristic mean drop diameters were determined for downstream and upstream injection into nonswirling and swirling airflows. The effects of the aerodynamic and liquid surface forces on the mean drop size were obtained with a scanning radiometer. Water jet breakup was studied primarily in the acceleration wave regime with values of WeRe > 10 to the 6th power and the following empirical expression was obtained: D(o)/D(m) = C (WeRe) to the 0.4, power where D(o) and D(m) are the orifice and mean drop diameters, respectively. We and Re are the Weber and Reynolds numbers defined as repectively, We = rho(a)D(o)V(r) /sigma and Re = D(o)V(r)/nu, where V(r) and rho(a) are airstream relative velocity and density, respectively, and sigma and nu are surface tension and kinematic viscosity of the liquid, respectively. The proportionally constant C was evaluated as follows: for downstream injection, C = 0.023 with nonswirling airflow, and C = 0.027 with swirling airflow. For upstream injection, the empirical expression D(o)/D(m) = 0.0045 (WeRe) to the 0.5 power was obtained with nonswirling airflow. Experimental conditions included a water flow rate of 68 liter per hour and an airflow rate per unit area range of 4.6 to 25.2 gm/sq cm sec at 293 K and atmospheric pressure. A.R.H.

N81-21311*# National Aeronautics and Space Administration, Washington, D. C.

AN EXPERIMENTAL INVESTIGATION ON THE SUBCRITICAL INSTABILITY IN PLANE POIESEUILLE FLOW

T. Nishioka, S. Honda, and S. Kamibayashi Jan. 1981 15 p refs Transl. into ENGLISH of "Heimen Poazuiyu Ryu ni Okeru Subcritical Instability no Jikenteki Kenkyu" Japan, p 55-62 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75885) Avail: NTIS HC A02/MF A01 CSCL 20D

The relationship between the three dimensional properties of the fundamental flow of a plane Poieseuille flow and subcritical stability was studied. An S-T wave was introduced into the flow and the three dimensional development of the wave observed. Results indicate that: (1) the T-S wave has three dimensional properties which are synchronous with the fundamental flow, but there is damping at microamplitude; (2) when the amplitude reaches a certain threshold, subcritical instability and peak valley bifurcation occur simultaneously and a peak valley structure is formed; (3) this threshold depends to a great extent on the frequency; and (4) after the peak valley bifurcation there is a transition to a turbulent flow by the process of laminar flow collapse identical to that in Blasius flow. M.G.

N81-21312*# Boeing Aerospace Co., Seattle, Wash. Advanced Transportation Organization.

THERMAL CONDUCTIVITY OF RENE 41 HONEYCOMB PANELS Contractor Report, Aug. 1979 - Feb. 1981

V. Deriugin Dec. 1980 47 p refs

(Contract NAS1-14213)

(NASA-CR-159367; D-180-26373-1) Avail: NTIS HC A03/MF A01 CSCL 20D

Effective thermal conductivities of Rene 41 panels suitable for advanced space transportation vehicle structures were determined analytically and experimentally for temperature ranges between 20.4 K (423 F) and 1186 K (1675 F). The cryogenic data were obtained using a cryostat whereas the high temperature data were measured using a heat flow meter and a comparative thermal conductivity instrument respectively. Comparisons were made between analysis and experimental data. Analytical methods appear to provide reasonable definition of the honeycomb panel effective thermal conductivities. Author

N81-21313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF A METHOD FOR HEAT TRANSFER MEASUREMENTS AND THERMAL VISUALIZATION USING A COMPOSITE OF A HEATER ELEMENT AND LIQUID CRYSTALS

Steven A. Hippensteele, Louis M. Russell, and Francis S. Stepka Apr. 1981 22 p refs Presented at the 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981; sponsored by ASME Original contains color illustrations

(NASA-TM-81639; E-656) Avail: NTIS HC A02/MF A01 CSCL 20D

Commercially available elements of a composite consisting of a plastic sheet coated with liquid crystal, another sheet with a thin layer of a conducting material (gold or carbon), and copper bus bar strips were evaluated and found to provide a simple, convenient, accurate, and low-cost measuring device for use in heat transfer research. The particular feature of the composite is its ability to obtain local heat transfer coefficients and isotherm patterns that provide visual evaluation of the thermal performances of turbine blade cooling configurations. Examples of the use of the composite are presented. Author

N81-21314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLOW THROUGH AXIALLY ALIGNED SEQUENTIAL APERTURES OF THE ORIFICE AND BORDA TYPES

R. C. Hendricks and T. Trent Stetz 1981 17 p refs Proposed for presentation at the 20th Natl. Heat Transfer Conf., Milwaukee, 2-5 Aug. 1981; sponsored by ASME and AIChE

(NASA-TM-81681; E-707) Avail: NTIS HC A02/MF A01 CSCL 20D

Choked flow rate and pressure profile data were obtained and studied for two axially aligned sequential configurations consisting of four Borda type inlets of 1.9 1/D with two separation distances of 0.8 and 30 diameters and four orifice type inlets of 0.5 1/D with two separation distances of 0.66 and 32 diameters. Data were obtained using fluid nitrogen over the reduced inlet temperature and pressure range 0.68 < T/T sub c < gas and P/P sub c to 2. A flow coefficient reduced temperature plot can be used to represent the flow rate data for each geometry. At the larger separation distances, the pressure profiles dropped sharply at the entrance and partially recovered within each of the Borda and orifice inlet configurations; the exception being the last inlet where at low entrance temperatures, fluid jetting could occur. For the smaller spacings fluid jetting was prevalent throughout each of the inlet configurations at lower inlet temperatures. These results are in qualitative agreement with data of tubes with single Borda or sharp edge orifice type inlets to 105 1/D and water flow visualization studies. DOE

N81-21315# Calspan Advanced Technology Center, Buffalo, N.Y.

AN APPLICATION OF IMPLICIT TIME MARCHING TO THREE DIMENSIONAL FLOW THROUGH A COMPRESSOR BLADE ROW Interim Report

William J. Rae Nov. 1980 49 p refs

(Contract F49620-78-C-0057; AF Proj. 2307)

(AD-A096354; CALSPAN-6275-A-4; AFOSR-81-0153TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Efforts to develop an implicit time-marching method for calculating the flow through a compressor blade row are reported. The flow is taken to be inviscid, and steady in blade-fixed coordinates. A conformal-mapping technique was used to generate a boundary-conforming grid, and a number of attempts were made to calculate the flow through a cascade of blades. Instabilities in the calculated results prevented the achievement of steady-state solutions. The instabilities are caused by singularities in the metrics of the coordinate transformation, especially at the trailing edges of the blades. GRA

N81-21316# Cambridge Hydrodynamics, Inc., Mass.

APPLICATIONS OF NUMERICAL CONFORMAL MAPPING Interim Technical Report

Daniel I. Meiron, Steven A. Orszag, and Moshe Israeli Jul. 1980 38 p refs

(Contract N00014-80-C-0127; Grant AF-AFOSR-3405-77)

(AD-A095886; CHI-34) Avail: NTIS HC A03/MF A01 CSCL 12/1

The application of conformal mapping methods to the solution of free-surface flow problems is considered. Methods of numerical conformal mapping based on Fourier series are extended to handle efficiently problems with time-dependent boundaries. They are shown to be practicable only for moderately distorted geometries. Extensions of the Menikoff-Zemach method to breaking geometries are presented. This method works well at large distortions. GRA

N81-21317# Catholic Univ. of America, Washington, D.C. Acousto-Optics Lab.

NUMERICAL PREDICTION OF SUPERSONIC BULK-CAVITATION CLOSURE PULSES Technical Report, Apr. 1980 - Jan. 1981

Joseph A. Clark Jan. 1981 27 p refs

(Contract N00014-76-C-1020)

(AD-A095887; A-O-LAB-1-81) Avail: NTIS HC A03/MF A01 CSCL 20/4

Two numerical approaches to the problem of theoretically predicting closure pulses produced by bulk cavitation are reviewed: a single-stage, finite-difference approach based directly on the governing differential equations of hydrodynamics and a multi-stage approach which assumes several different simplified formulations of the governing equations at different times during the bulk cavitation process. New extensions to both current approaches are reported by the author and used to solve an example problem. In particular, a new graphical method for predicting the form of closure pulses everywhere except near regions of subsonic closure is described. The two numerical approaches are compared on the basis of the example problem solutions and several aspects of the methods which require further development are identified. GRA

N81-21318# *Maine Univ., Orono. Dept. of Physics.*
INVESTIGATION OF BULK TURBULENCE AND NONLINEAR WAVE PHENOMENA IN LIQUID HELIUM Interim Report, 1 Oct. 1979 - 30 Sep. 1980
James A. Rooney and Charles W. Smith Sep. 1980 27 p refs
(Grant AF-AFOSR-3113-76; AF Proj. 2301)
(AD-A095868; AFOSR-81-0186TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Generation of Turbulence by Ultrasound in Hell, use of Acousto-optic Techniques to Detect Subharmonic and Cavitation Activity, Use of Acousto-optic Techniques to Measure Nonlinear Properties of Cryogenic Liquids, and Studies of Acoustic Streaming in Superfluid Helium are described. GRA

N81-21319# Physical Sciences, Inc., Woburn, Mass.
TURBULENT BOUNDARY LAYER HEAT Annual Report, 1 Nov. 1979 - 31 Oct. 1980
Michael L. Finson, A. S. Clarke, and P. K. S. Wu Jan. 1981 47 p refs
(Contract F49620-80-C-0015; AF Proj. 2307)
(AD-A096381; PSI-TR-244; AFOSR-81-0152TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A Reynolds stress model for turbulent boundary layers is used to study surface roughness effects on skin friction and heat transfer. The issues of primary interest are the influence of roughness character (element shape and spacing) and the nature of roughness effects at high Mach numbers. Computations based on the model compare satisfactorily with measurements from experiments involving variations in roughness character, in low speed and modestly supersonic conditions. The more limited data base at hypersonic Mach numbers is also examined with reasonable success, although no quantitative explanation is offered for the reduction of heat transfer with increasing roughness observed by Holden at Me -9.4. The present calculations indicate that the mean velocity is approximately uniform over much of the height range below the tops of the elements, y less than or equal to k. With this constant (roughness velocity,) it is simple to estimate the form drag on the elements. This roughness velocity has been investigated by systematically exercising the present model over ranges of potential parameters. The roughness velocity is found to be primarily a function of the projected element frontal area per unit surface area, thus providing a new and simple method for predicting roughness character effects. The model further suggests that increased boundary layer temperatures should be generated by roughness at high edge Mach numbers, which would tend to reduce skin friction and heat transfer, perhaps below smooth wall levels. GRA

N81-21320# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
SPECTRAL COMPUTATION OF TRIPLE-DECK FLOWS Progress Report, 1 Dec. 1978 - 31 Dec. 1980
Odus R. Burggraf and P. W. Duck (Manchester Univ., England) Jan. 1981 14 p refs Presented at the Symp. on Phys. and Numerical Aspects of Aerodynamic Flows, Long Beach, Calif., 20-22 Jan. 1981
(Contract N00014-76-C-0333)
(AD-A096355; TR-3) Avail: NTIS HC A02/MF A01 CSCL 20/4

The Fourier transform method is applied to the problem of computing viscous flows involving boundary-layer separation, based on the triple-deck model of viscous-inviscid flow interaction. As used here, the method is pseudo-spectral in that the nonlinear inertia terms are evaluated in physical variables, although the main computations are made in spectral variables. The Fast-Fourier-Transform algorithm is used to expedite the iterated transformations. The method is much faster than conventional finite-difference methods; typically only ten or twenty iterations suffice for convergence to four or five digits of accuracy. Furthermore, no artificial stabilization schemes are necessary to treat the reversed flows occurring in separated regions. Results are presented for both incompressible and supersonic flows, and are shown to compare well with previous finite-difference results. GRA

N81-21321# Naval Postgraduate School, Monterey, Calif.
OPTIMIZATION OF AN INTERNALLY FINNED ROTATING HEAT PIPE M.S. Thesis
William A. Davis, Jr. Sep. 1980 107 p refs
(AD-A096362) Avail: NTIS HC A06/MF A01 CSCL 13/1

A finite element formulation was used to solve the steady-state two-dimensional conduction heat transfer equation in the condenser wall section of an internally finned rotating heat pipe. A FORTRAN program using this method was coupled with the COPES/CONMIN program for sensitivity analysis of design variables and for automated design of the internal heat pipe geometry. With water as the working fluid, numerical results obtained for copper and stainless steel heat pipe condenser sections indicated that for the maximum heat transfer rate, the designer should machine as many fins as the condenser material and the manufacturing process will allow. A saw tooth profile is preferable to spacing between fins. GRA

N81-21322# *Naval Postgraduate School, Monterey, Calif.*
HEAT EXCHANGER OPTIMIZATION M.S. Thesis
Conrad P. Hedderich Sep. 1980 189 p refs
(AD-A096350) Avail: NTIS HC A09/MF A01 CSCL 13/1

A computer code was developed for the analysis of air-cooled heat exchangers and was coupled with a constrained function minimization code to produce an automated air-cooled heat exchanger design and optimization program with many new capabilities. A general iteration free approximation method was used for the analysis which calculates the mean overall heat transfer coefficient and the overall pressure drop for many flow arrangements, taking into account the variation of the heat transfer coefficients and the pressure drop with temperature and/or length of flow path. The code is not limited to surfaces found in the literature, but will accommodate any triangular pitch bank of finned tubes in multiple-pass configurations. GRA

N81-21323# *Naval Postgraduate School, Monterey, Calif.*
EFFECTS OF OSCILLATION FREQUENCY AND AMPLITUDE ON SEPARATION IN A UNSTEADY TURBULENT FLOW M.S. Thesis
Martin Fox Sep. 1980 100 p refs
(AD-A096386) Avail: NTIS HC A05/MF A01 CSCL 20/4

A two-dimensional model was developed and used in a preliminary investigation of the relationship between flow oscillation frequency, oscillation amplitude, and turbulent boundary layer separation in a low speed, oscillating wind tunnel. It was found that the frequency of oscillation had a profound effect upon the amplitude of oscillation and flow separation. Frequencies from 20 Hz to 28 Hz and 70 Hz to 80 Hz allowed attachment of the boundary layer, while other frequencies, up to 100 Hz, caused flow separation in an eighteen degree divergent section. GRA

N81-21324# Naval Postgraduate School, Monterey, Calif.
A PROCEDURE FOR OBTAINING VELOCITY VECTOR FROM TWO HIGH RESPONSE IMPACT PRESSURE PROBES Technical Report, Jul. 1979 - Jul. 1980
D. Adler and P. M. Taylor Aug. 1980 55 p refs Prepared in cooperation with Technion - Israel Inst. of Tech.
(AD-A096389; NPS67-80-007) Avail: NTIS HC A04/MF A01 CSCL 20/4

A method for experimentally determining the velocity vector for a point in a fluid, downstream of a rotating turboimpeller, is presented. The technique requires four pressure readings from two semiconductor pressure probes and a synchronization system to collect the data. Reduction of the data to the velocity and direction of the fluid particle is performed by the computer program at the end of this report. GRA

N81-21325# *Sandia Labs., Albuquerque, N. Mex. Combustion Science Dept.*
MASS, MOMENTUM AND ENERGY CONSERVATION EQUATIONS IN GENERALIZED CURVILINEAR COORDINATES: EQUATION DEVELOPMENT AND A PROPOSED SOLUTION TECHNIQUE
Reginald E. Mitchell Jan. 1981 30 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-8240) Avail: NTIS HC A03/MF A01

The equations that characterize the flow of a viscous, compressible reactive gas mixture are presented in generalized curvilinear coordinates. The equations allow the physical laws

that govern the transport of mass, momentum, and energy within a system to be described in a coordinate frame best suited to characterize the boundaries of the problem of concern. The equations feature certain nonlinearities that make the set of coupled, partial differential equations impossible to solve analytically. A numerical procedure is presented that employs the latest developments in implicit algorithms when solving the time dependent forms of the governing equations. DOE

N81-21326# Oak Ridge National Lab., Tenn. Computer Sciences Div.

ANALYSIS AND SOLUTION OF THE ILL-POSED INVERSE HEAT CONDUCTION PROBLEM

C. F. Weber Jan. 1981 37 p refs
(Contract W-7406-eng-26)
(ORNL/CSD/TM-144) Avail: NTIS HC A03/MF A01

The inverse conduction problem (when experimental measurements are taken in the interior of a body, and it is described to calculate temperature and heat flux values on the surface) is shown to be ill-posed, as the solution exhibits unstable dependence on the given data functions. A special solution procedure is developed for the one-dimensional case which replaces the heat conduction equation with an approximating hyperbolic equation. If viewed from the perspective, where the roles of the spatial and time variables are interchanged, then an initial value problem for the damped wave equation is obtained. Since this formulation is well-posed, both analytic and numerical solution procedures are readily available. Sample calculations confirm that this approach produces consistent, reliable results for both linear and nonlinear problems. DOE

N81-21327# Virginia Univ., Charlottesville. School of Engineering and Applied Science.

WAVES IN ROTATING FLUIDS

J. B. Morton and Gene R. Cooper Sep. 1980 63 p refs
(Contract DE-AC05-76OR-01779)
(UVA-ER-607-80U) Avail: NTIS HC A04/MF A01

Transverse and axial wave motion for a rotating inviscid perfect gas with an impressed temperature gradient and an impressed non-solid body steady state velocity profile is studied. The equations for wave motion are derived using a method similar to that of Hultgren. The possible wave velocities, mode shapes, and pressure distributions are compared to those for the case of isothermal solid body rotation. Considerations of mean free path and wave motion are presented for both the impressed temperature distribution and the impressed velocity profile. The modifications on wave velocity, mode shape, and pressure due to the mean free path considerations are also given. DOE

N81-21328# Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF CELLULAR CONVECTION WITH REGARD TO THE PREPARATION OF SPACE EXPERIMENTS Final Report

Herbert Oertel and Karl-Reiner Kirchartz Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-39; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

Information about cellular convection in closed cavities heated from below was sought. The effects of time-dependent heating, additional horizontal temperature gradients and Coriolis and centrifugal forces on thermal instabilities in a rotating convection box were investigated. The Galerkin method was used to calculate the onset of steady and time-dependent convection. Convection in the region described by the nonlinear basic equations was investigated using an explicit finite element method. The differential interferometric and anemometric techniques developed are described together, with their utilization. The use of the methods to study the effects of low gravity and centrifugal forces on density-stratified fluids is described. Author (ESA)

N81-21329# Ruhr Univ., Bochum (West Germany). Inst. fuer Thermo- und Fluiddynamik.

BEHAVIOR OF TURBULENT BOUNDARY LAYERS AFTER A STRONG DISTURBANCE [TURBULENTE SCHERCHICHTEN UNTER DEM EINFLUSS VON STARKEN STOERUNGEN]

K. Gersten and S. Kiske Bonn Bundesministerium des Verteidigung 1980 38 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium des Verteidigung
(BMVg-FBWT-80-5) Avail: NTIS HC A03/MF A01

The effect of strong disturbances caused by sudden changes in wall roughness was investigated both experimentally and theoretically. Experimental results show the flow to have a three layer structure, each of these layers being characterized by a different scaling behavior. Calculations based on a model show that the experimentally determined flow structure can only be partially predicted. An integral method is presented for calculating the turbulent boundary layer after a jump in wall roughness; it takes the three layer structure into account and involves an entrainment concept. The results obtained in this way for the magnitude of the various flow parameters are good. Author (ESA)

N81-21330# Oxford Univ. (England). Engineering Lab.

NOISE GENERATION IN CAVITATING FLOWS. THE SUBMERGED WATER JET. PART 1

R. E. Franklin and J. McMillan 1980 34 p refs 2 Vol.
(Contract Min-Def/ERC/9/4/2057/070)
(OUEL-1312/80-Pt-1) Avail: NTIS HC A03/MF A01

Several mechanisms by which noise can be generated in a submerged jet were identified. Calculations were performed on noise generation by the oscillations of bubble nuclei excited by the sudden pressure drop occurring in the nozzle with which the flow is set up. Comparisons between experimental results and theoretical predictions demonstrated the validity of the arguments developed. Author (ESA)

N81-21331# Oxford Univ. (England). Engineering Lab.

NOISE GENERATION IN CAVITATING FLOWS. PART 2. THE SUBMERGED JET

R. E. Franklin and J. McMillan 1980 33 p refs 2 Vol.
(Contract Min-Def/ERC/9/4/2057/070)
(OUEL-1313/80-Pt-2) Avail: NTIS HC A03/MF A01

The case when the jet static pressure is not necessarily low was studied. The main characteristics of the noise generated by cavitation in the mixing layer of the submerged jet can be estimated with a fair degree of accuracy from the structure of noncavitating jets. Agreement between experimental data and theoretical results is good. Author (ESA)

N81-21332# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Stroemung und Verbrennung.

CALCULATION OF COMPRESSIBLE SWIRLING FLOWS IN PIPES, ANNULI, AND ON ROTATING CYLINDERS

Wilhelm A. Neuberger Mar. 1980 108 p refs In GERMAN; ENGLISH summary
(Contract DFG-NE-198/1)
(DFVLR-FB-80-21) Avail: NTIS HC A06/MF A01

A finite difference method for the calculation of compressible swirling flows is derived. The extent to which these flows can be described by a quasicylindric approximation of the conservation laws is demonstrated. The boundary layer characteristics of the established flow model are summarized. The impulse and energy axial diffusion flow components are neglected opposite the radial diffusion flow and opposite the axial convection flow. The coupled second order partial differential equations which describe the transport process are thus parabolic. The pressure gradient in the radial direction is only affected by centrifugal acceleration. The boundary value can be either of the first of second type, i.e., Dirichlet or Neumann boundary values. In practice, calculation of the temperature variation at the boundary is now possible when the axial variation in heat flow density is known. Author (ESA)

N81-21333# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

INTEGRAL EQUATION DESCRIBING THE VELOCITY FIELD OF IRROTATIONAL FLOWS AROUND BLUNT BODIES

Barbara SchmittvonSchubert Aug. 1980 37 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(ESA-TT-702)
(DFVLR-FB-80-25) Avail: NTIS HC A03/MF A01

An integral equation which characterizes the velocity of the stationary flow around blunt bodies is derived. The flow is assumed irrotational, i.e. only such discontinuity surfaces occur for which this assumption remains valid. The behavior of the integral equation at such a discontinuity surface is discussed. The solution of the equation is shown similar to the solution of a wall flow equation. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-21334# Arizona Univ., Tucson. Optical Sciences Center.
LASER GYRO THEORY EXTENSION *Final Scientific Report, 22 Mar. 1979 - 22 Sep. 1980*
Marlan O. Scully Dec. 1980 43 p refs
(Contract F33615-79-C-1744; AF Proj. 2305)
(AD-A096145; Rept-2305; AFWAL-TR-80-1210) Avail: NTIS HC A03/MF A01 CSCL 20/5

Three investigations have been completed under the contract entitled 'Laser Gyro Theory Extension,' as follows: (1) The accuracy of the Zeeman laser gyro (ZLAG) theory was tested by comparing *its predictions with experimental results. (2) Other multioscilla-* tor approaches to solving the lock-in problem have been investigated. (3) Two earthbound experiments to test general and special relativity theories were designed, based on the Sagnac interferometer. GRA

N81-21335# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GRAPHOEPITAXY Semiannual Technical Summary Report, 1 Jul. - 31 Dec. 1979
Henry I. Smith 31 Dec. 1979 13 p refs
(Contract F19628-80-C-0002; ARPA Order 3336)
(AD-A096064; ESD-TR-80-214) Avail: NTIS HC A02/MF A01 CSCL 06/17

A new technique for fabricating high-contrast X-ray masks with simple patterns of lines and spaces less than 50 A in width is described. The successful replication of 175-A lines and spaces in polymethyl methacrylate (PMMA) using the carbon K (45-A) X-ray is reported. It was found that PMMA structures smaller than 150 A in width lost their physical integrity and would not adhere to SiO2 substrates. GRA

N81-21336# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
STATISTICAL ANALYSIS OF THE CALIBRATION PROCEDURE FOR PERSONNEL RADIATION MEASUREMENT INSTRUMENTS
W. J. Bush, S. J. Bengston, F. L. Kalbeitzer (DOE, Idaho Falls), J. P. Cusimano (DOE, Idaho Falls), and V. P. Gupta (DOE, Idaho Falls) Nov. 1980 75 p refs
(Contract DE-AC07-76ID-01570)
(IDO-12091) Avail: NTIS HC A04/MF A01

Thermoluminescent analyzer (TLA) calibration procedures were used to estimate personnel radiation exposure levels. A statistical analysis is presented based on data collected over a six month period. The data were collected according to the day-to-day procedure in effect at the time. Both gamma and beta radiation models are developed. Observed TLA readings of thermoluminescent dosimeters are correlated with known radiation levels. This correlation is then used to predict unkown radiation doses from future analyzer readings of personnel thermoluminescent dosimeters. The statistical techniques applied in this analysis include weighted linear regression, and estimation of systematic and random error variances. DOE

N81-21337# California Univ., Berkeley. Lawrence Berkeley Lab. Physics, Computer Science and Mathematics Div.
LIMITS TO IMAGE RECONSTRUCTION FROM RESTRICTED ANGULAR INPUT
K. C. Tam and V. Perez-Mendez Nov. 1980 13 p refs Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5-8 Nov. 1980 *Prepared in cooperation with General Electric Co., Schenectady, N.Y.*
(Contract W-7405-eng-48)
(LBL-11834; CONF-801103-38) Avail: NTIS HC A02/MF A01

Distortion in an object due to the unavailability of some Fourier components in a cone-shaped region is analyzed. The results throw light on the factors that limit the accuracy in reconstructing objects from limited angle input in practice. It is also shown that norm or entropy related reconstruction methods are not expected to improve the fidelity of the reconstructed images; only more a priori knowledge of exact nature on the object can serve this purpose. DOE

N81-21338# *Los Alamos Scientific Lab., N. Mex. Health Div.*
NEW DEVELOPMENTS IN RADIATION PROTECTION INSTRUMENTATION VIA ACTIVE ELECTRONIC METHODS
C. John Umbarger 1981 20 p refs Presented at the Meas. Sci. Conf., Anaheim, Calif., 30-31 Jan. 1981
(Contract W-7405-eng-36)
(LA-UR-80-2523; CONF-810103-1) Avail: NTIS HC A02/MF A01

Developments in electronics and radiation detectors for real time data acquisition of radiation exposure and contamination conditions are discussed. Developments in low power circuit designs, hybrid and integrated circuits, and microcomputers are described. Developments in radiation detectors, such as cadmium telluride, gas scintillation proportional counters, and imaging counters (both charged particle and photon) are also examined. DOE

N81-21339# Stuttgart Univ. (West Germany). Inst. fuer Uhrentechnik und Feinmechanik.
SHUTTER CONTROL OF AUTO-EXPOSURE STILL CAMERAS WITH DIGITAL ELECTRONIC CIRCUITRY Final Report
Manfred Ackermann Bonn Bundesministerium fuer Forschung und Technologie Jul. 1980 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-028; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

A camera shutter design was studied in which exposure duration is determined by integrating the light entering the objective once the shutter has already been opened. The circuitry employed is described together with the functions of the various electronics and optoelectronics used. Results of the different tests are given. The system is applicable to medium price ranged cameras. Emphasis is given to the high performance that can be achieved and to the much greater accuracy that can be obtained specially for changing lighting levels and long exposures. Author (ESA)

N81-21340# European Space Agency, Paris (France).
STUDY OF AN EXPERIMENTAL PROBE FOR THE MEASUREMENT OF THE ACOUSTIC PRESSURE INSIDE AN AIR FLOW Thesis - Paris Univ.
Herve Huguenin Mar. 1981 113 p refs Transl. into ENGLISH of "Etude d'une Sonde Exptl. Destinee a la Mesure d'une Pression Acoustique dans un Ecoulement d'air" Rept. ONERA-NT-1979-5, ONERA, 1979 Original report in FRENCH previously announced as N80-24133
(ESA-TT-633; ONERA-NT-1979-5) Avail: NTIS HC A06/MF A01

The turbulence generated by the presence of a microphone, placed to study the origin of noise of an aircraft in motion, and the effect it has on the measurements of acoustic pressure within the fluids in motion, are discussed. An acoustic probe designed to reduce the influence of the instrument during such measurements is described. The parabolic shaped probe contains the

pressure tapping in an annular slot around the circumference of the nose. Performance tests in a wind tunnel showed improved performance over microphones in nonturbulent flow.

Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-21341*# Laser Analytics, Inc., Bedford, Mass.
DEVELOPMENT OF LEAD SALT SEMICONDUCTOR LASERS FOR THE 9-17 MICRON SPECTRAL REGION Contractor Report, 22 Dec. 1977 - 15 Aug. 1980
K. J. Linden, J. F. Butler, K. W. Nill, and R. E. Reeder Mar. 1981 104 p refs
(Contract NAS1-15190)
(NASA-CR-165682) Avail: NTIS HC A06/MF A01 CSCL 20E

Improved diode lasers of Pb sub 1-x Sn sub x Se operating in the 9-17 micrometers spectral region were developed. The performance characteristics of the best lasers exceeded the contract goals of 500 microW/mode at T > 30K in the 9-12 micrometers region and 200 microW/mode at T > 18K in the 16-17 micrometers region. Increased reliability and device yields resulted from processing improvements which evolved from a series of diagnostic studies. By means of Auger electron spectroscopy, laser shelf storage degradation was shown to be characterized by the presence of In metal on the semiconductor crystal surfaces. Studies of various metal barrier layers between the crystals and the In metal led to the development of an improved metallurgical contacting technology which has resulted in devices with performance stability values exceeding the contract goal of a one year shelf life. Lasers cycled over 500 times between 300K and 77K were also shown to be stable. Studies on improved methods of fabricating striped geometry lasers indicated that good spectral mode characteristics resulted from lasers which stripe widths of 12 and 25 micrometers. Author

N81-21342*# Maryland Univ., College Park. Dept. of Electrical Engineering.
CONTINUED LIFE TEST RESULTS FOR AN ENSEMBLE OF CO2 LASERS Final Report
Urs E. Hochuli Apr. 1981 13 p
(Grant NaG-5042)
(NASA-CR-164184) Avail: NTIS HC A02/MF A01 CSCL 20E

The life test results of five 16 low pressure CW CO2 lasers with a nominal output of 1 watt are presented. One laser quickly died while the remaining four lasers reached half power output at 38,000, 40,000, >40,000 and >40,000 hours respectively. These results show the potential for a 50,000 hour laser while the average life of the 16 tested lasers was 22,500 hours. It is further indicated that the cathode sputtering products, which settle on the glass walls of the cathode sleeve, form an increasingly heavy film as the laser ages. R.C.T.

N81-21343# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
LARGE-DIAMETER CO2 LASER FACILITY FOR TESTING OPTICAL RESONATORS Interim Report
Eugene B. Turner and Richard A. Chodzko 29 Sep. 1980 41 p
(Contract F04701-79-C-0080)
(AD-A096267; TR-0080(5605)-2; AD-TR-80-89) Avail: NTIS HC A03/MF A01 CSCL 20/5

A closed-cycle CO2 laser facility with a clear aperture diameter of 18.7 cm was developed for testing large diameter optical resonators designed for use with cylindrical chemical lasers that have an annular gain region. In this report, the considerations that lead to the present laser facility design are discussed, and the results of the open-cycle tests that established the feasibility of the design are presented. The closed-cycle gas flow system and the high-voltage electrical discharge circuits are described, the operating parameters are given, and the results of some gas flow and electrical discharge measurements are presented. The performance of the facility was established by gain measurements and by the game quality obtained with several resonators. GRA

N81-21344# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LASER-INDUCED DAMAGE TO THIN FILM DIELECTRIC COATINGS Ph.D. Thesis
Thomas W. Walker Oct. 1980 136 p refs
(AD-A096051; AFIT/DS/PH/80-4) Avail: NTIS HC A07/MF A01 CSCL 11/3

The laser-induced damage thresholds of dielectric thin film coatings have been found to be more than an order of magnitude lower than the bulk material damage thresholds. Prior damage studies have been inconclusive in determining the damage mechanism which is operative in thin films. A program was conducted in which thin film damage thresholds were measured as a function of laser wavelength (1.06 micron, 0.53 micron, 0.35 micron and 0.26 micron), laser pulse length (5 and 15 nanoseconds), film material and film thickness. The large matrix of data was compared to predictions given by avalanche ionization, multiphoton ionization and impurity theories of laser damage. When Mie absorption cross-sections and the exact thermal equations were included into the impurity theory, excellent agreement with the data was found. The avalanche and multiphoton damage theories could not account for most parametric variations in the data. For example, the damage thresholds for most films increased as the film thickness decreased and only the impurity theory could account for this behavior. Other observed changes in damage threshold with changes in laser wavelength, pulse length and film material could only be adequately explained by the impurity theory. The conclusion which results from this study is that laser damage in thin film coatings results from absorbing impurities included during the deposition process. GRA

N81-21345# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ON THE GENERATION OF STRESS AND DEFORMATION IN ELASTIC SOLIDS BY HIGH POWERED LASERS Technical Report, 1 Apr. 1979 - 30 Aug. 1980
Peter J. Torvik Sep. 1980 131 p
(AD-A096373; AFIT-TR-80-6) Avail: NTIS HC A07/MF A01 CSCL 20/5

The various mechanisms by which stresses may be generated in an elastic solid by the absorption of laser energy are reviewed. Through the use of simplification and idealizations, analyses of the stresses generated by each mechanism are developed and discussed. The role of the mechanical boundary conditions on the stresses generated is given particular attention. In each case, emphasis is given to the prediction of failure times. GRA

N81-21346# Arizona Univ., Tucson. Optical Sciences Center.
GENERATION OF A CONJUGATE WAVE FROM A WEAK SIGNAL Final Report, 30 Jun. 1976 - 30 Sep. 1980
Frederic A. Hopf Dec. 1980 15 p refs
(Grant AF-AFOSR-3079-76; AF Proj. 2301)
(AD-A095873; AFOSR-81-0114TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

To correct for focus distortions that arise when laser light is focused on a target through a turbulent medium, we had proposed to generate a compensating wavefront by means of optical parametric amplification (OPA). This report describes our efforts toward this end. GRA

N81-21347# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
STATE TO STATE STUDIES OF ENERGY TRANSFER PROCESSES Final Report, 1 Jan. 1976 - 31 Dec. 1980
David E. Pritchard Jan. 1981 11 p
(Grant AF-AFOSR-2972-76; AF Proj. 2301)
(AD-A095870; AFOSR-81-0189TR) Avail: NTIS HC A02/MF A01 CSCL 20/10

Studies of molecular energy transfer processes, including chemical reactions, were carried out. Also our studies of collision processes were continued. Atomic and molecular energy transfer processes were the object of considerable theoretical and experimental study. Our studies of collisional energy transfer processes in molecules, with particular emphasis on Rotational

and Vib-Rotational Energy Transfer (REF and VRET) were satisfactory. GRA

N81-21348# Rochester Univ., N. Y. Dept. of Chemistry.
QUANTUM DYNAMICAL MODEL OF LASER/SURFACE-INDUCED PREDISSOCIATION: MULTIPHOTON-MULTIPHONON PROCESSES AND PHOTON/PHOTON-DRESSED STATES Interim Technical Report
Jui-Teng Lin and Thomas F. George Feb. 1981 26 p refs Submitted for publication
(Contracts N00014-80-C-0472; F49620-78-C-0005; NR Proj. 056-749)
(AD-A096345; TR-10) Avail: NTIS HC A03/MF A01 CSCL 20/5

By the dynamical energy populations of photon/phonon-dressed quantum system, laser-stimulated surface predissociation (LSSPD) of an adsorbed diatomic molecule, characterized by the laser pumping rates, the phonon-induced damping factor (level width), the field detuning, and the phase detuning (Landau-Zener form), is studied. The optimal detunings for the enhancement of LSSPD are shown by the numerical results of a set of coupled generalized quantum equations (GQE). The important features of LSSPD and the possible predissociation of a multilevel multistate system via multiphoton-multiphonon processes are discussed. GRA

N81-21349# Rochester Univ., N. Y. Dept. of Chemistry.
CLASSICAL STOCHASTIC MODEL OF LASER-STIMULATED SURFACE PROCESSES AND THE SELECTIVE NATURE OF LASER EXCITATION VIA MULTIPHONON COUPLINGS Interim Report
Jui-Teng Lin and Thomas F. George Feb. 1981 33 p refs Submitted for publication
(Contract N00014-80-C-0472; NR Proj. 056-749)
(AD-A096357; TR-11) Avail: NTIS HC A03/MF A01 CSCL 20/5

The dynamical behavior of laser-stimulated surface processes (LSSP) is studied by the generalized Langevin equation via the memory effects of the damping kernel, the dephasing kernel and mode-mode interactions. The temperature-dependent averaged energy absorption rate (which characterizes the line shape) is calculated by solving the Laplace-Fourier transform of the velocity correlation function. The features of the response function and its overall line broadening are discussed in terms of Markovian processes. The nature of LSSP and laser-selective effects are discussed in terms of the multiphonon coupling strength and the related 'internal resonant' condition. It is shown that laser-selective bond breaking is possible for a slow intermolecular vibrational relaxation rate which is governed by a high-order multiphonon process or a far off 'internal resonance'. GRA

N81-21350# Sanders Associates, Inc., Nashua, N. H.
LASER QUALITY SINGLE CRYSTAL SPECIMENS Final Report, 27 Sep. - 30 Nov. 1980
T. Pollak 15 Dec. 1980 21 p
(Contract N00173-79-C-0343)
(AD-A096253) Avail: NTIS HC A02/MF A01 CSCL 20/2

Research and development on the crystalline laser host, YLF (LiYF4), was completed during this program. The study involved crystal growth and sample fabrication of rare earth doped YLF. These materials were then evaluated at NRL. A total of 16 laser samples, eight different compositions, were processed during this contract period. GRA

N81-21351# California Univ., Livermore. Lawrence Livermore Lab.
LASER-INDUCED DAMAGE MEASUREMENTS WITH 266-nm PULSES
T. F. Deaton and W. L. Smith 23 Jan. 1980 12 p refs Presented at the Symp. on Opt. Materials for High Power Lasers, Boulder, Colo., 30 Oct. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83304; CONF-7910101-3) Avail: NTIS HC A02/MF A01

The results of a survey of laser induced damage thresholds for optical components at 266 nm are reported. The thresholds were measured at two pulse durations (0.150 ns and 1.0 ns). The 30 samples tested include four commercial dielectric reflectors, three metallic reflectors, two antireflection films, a series of eight half wave oxide and fluoride films, and twelve bare surfaces (fluoride crystals, silica, sapphire, BK-7 glass, CD*A and KDP). The 266 nm pulses were obtained by frequency quadrupling a Nd:YAG, glass laser. Equivalent plane imagery and calorimetry were used to measure the peak fluence of each of the UV pulses with an accuracy of + or - 15%; the uncertainty in the threshold determinations is typically + or - 30%. DOE

N81-21352# Sandia Labs., Albuquerque, N. Mex.
HF CHEMICAL LASERS IGNITED BY CO2-LASER IRRADIATION
John C. Cummings 1980 7 p refs Presented at the 3d Intern. Conf. on Lasers and Appl., New Orleans, 15 Dec. 1980
(Contract DE-AC04-76DP-00789)
(SAND-81-0218C; CONF-801201-10) Avail: NTIS HC A02/MF A01

A pulsed CO2 laser was used to ignite mixtures of SF6: H2 and S2F10:H2. The chemical reactions initiated by the CO2 laser produce vibrationally-excited HF which were observed to lase when an optical resonator was constructed around the reaction cell. The HF-lasing performance of these gas mixtures as a function of mixture ratio, pressure, and several CO2 laser parameters (frequency, fluence, and pulse duration) are compared. Under comparable conditions, the HF-laser output for S2F10: H2 mixtures was approx. 6 times greater than that for SF6: H2 mixtures. Two results were observed that are not fully understood at present: first, the HF-laser output for S2F10:H2 mixtures increased linearly with CO2 laser fluence, reached a maximum value, and then decreased - this decrease may be due to excessive heating of the gases; second, variations in CO2 laser frequency indicated that the frequency for maximum HF-laser energy from S2F10:H2 mixtures was blue-shifted with respect to the peak absorption frequency for S2F10 - this may be due to significant SF5 absorption of the CO2 laser radiation. DOE

N81-21353# Los Alamos Scientific Lab., N. Mex.
PULSE PROPAGATION IN A ONE-ATMOSPHERE CO2 LASER AMPLIFIER
Stephen J. Czuchlewski [1981] 19 p refs Presented at the 3d Intern. Conf. on Lasers and Appl., New Orleans, 15-19 Dec. 1980
(Contract W-7405-eng-36)
(LA-UR-81-15; CONF-801201-7) Avail: NTIS HC A02/MF A01

The theoretical propagation of short (150-ps) laser pulses in a one atmosphere CO2 amplifier is investigated using a fully coherent density matrix computer code. The influence of coherent effects and of the response times of the amplifying medium on the temporal shape of the output pulse is examined. It is found that short pulses, whose width is approximately equal to the T2 time of the medium, can be effectively amplified. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-21354 Centre National d'Etudes Spatiales, Toulouse (France). Dept. Stabilisation-Systemes.
ENERGY DISSIPATION IN EXOSAT TANKS. TESTS RESULTS AND SYNTHESIS
J. L. Marce, L. Torres, D. Assemat (Societe pour le Perfectionnement des Materiels et Equipment Aerospatiaux), and S. Michel (Societe pour le Perfectionnement des Materiels et Equipment Aerospatiaux) 1 Aug. 1980 47 p refs
(CNES-80/CT/PRT/SST/SS/229) Avail: NTIS HC A03/MF A01

The time constant of nutation buildup onboard the EXOSAT + fourth stage (P 0.7) assembly, during transfer orbit, during P 0.7 firing, and after P 0.7 firing, was determined through simulation tests, using an air bearing spin testing facility. Only energy dissipation due to fuel motion, and at different filling ratios, in the two propane tanks and the hydrazine tank was considered. The EXOSAT + P 0.7 assembly is spin stabilized with a spin rate of 50 rpm during transfer orbit. The unstable

assembly is fitted with an active notation damping system. Spin test data is used in dimensioning this damping system. Results show that a hysteresis phenomenon, observed with the hydrazine tank, the main source of dissipation, giving a time constant of notation buildup 10 times lower than that of the programs tanks alone. Additional results show that the diaphragm tank has a rather different behavior from a tank fitted with a rigid wall, its adimensional dissipation is approximately six to seven times greater than that of a bare tank. Additional results are discussed. Author (ESA)

N81-21355*# Mechanical Technology, Inc., Latham, N. Y.
AN EXPERIMENTAL EVALUATION OF OIL PUMPING RINGS
Martin W. Eusepi, Jed Walowit, and Maurice Cohen Apr. 1981 117 p refs
(Contracts DEN3-119; EC-77-A-31-1040)
(NASA-CR-165271; DOE/NASA/0119-81/1; MTI-81TR3) Avail: NTIS HC A06/MF A01 CSCL 13I

The design and construction of a reciprocating test vehicle to be used in evaluating hydrodynamic oil pumping rings are discussed. In addition, experimental test data are presented for three pumping ring designs that were constructed from Tin-Based Babbitt (SAE 11), Bearing Bronze (SAE 660), and Mechanical Carbon Graphite (Union Carbide Grade CNF-J). Data of pumped flow rate versus delivered pressure, as well as friction loss, are reported for the following conditions: frequencies of 10, 35 and 45 Hz; strokes of 25.4 mm (1.00 in.), 38.1 mm (1.50 in.) and 50.8 mm (2.00 in.) oil inlet temperature of 49 degrees (120 degrees); and pumping ring close-in pressures of 10.3 MPa (1500 lb/square inch. A 20W40 automotive oil was used for all tests. The maximum delivered pressure was 11 MPa (1600 lb/square inch. An analysis of hydrodynamic oil pumping rings was performed and the results of the analysis were compared to measured test data. S.F.

N81-21356*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SURFACE ROUGHNESS ON HYDRODYNAMIC BEARINGS
Bankim C. Majumdar and Bernard J. Hamrock 1981 24 p refs Proposed for presentation at Joint Lubrication Conf., New Orleans, 5-7 Oct. 1981; sponsored by ASME and ASLE
(NASA-TM-81711; E-698) Avail: NTIS HC A02/MF A01 CSCL 13I

A theoretical analysis on the performance of hydrodynamic oil bearings is made considering surface roughness effect. The hydrodynamic as well as asperity contact load is found. The contact pressure was calculated with the assumption that the surface height distribution was Gaussian. The average Reynolds equation of partially lubricated surface was used to calculate hydrodynamic load. An analytical expression for average gap was found and was introduced to modify the average Reynolds equation. The resulting boundary value problem was then solved numerically by finite difference methods using the method of successive over relaxation. The pressure distribution and hydrodynamic load capacity of plane slider and journal bearings were calculated for various design data. The effects of attitude and roughness of surface on the bearing performance were shown. The results are compared with similar available solution of rough surface bearings. It is shown that: (1) the contribution of contact load is not significant; and (2) the hydrodynamic and contact load increase with surface roughness. Author

N81-21357# Federal Aviation Administration, Atlantic City, N.J.
BRAKING PERFORMANCE OF A UNITED STATES AIR FORCE FOUR-GROOVE 49 X 17 AIRCRAFT TIRE WITH AND WITHOUT SIPES Final Report, Jul. - Oct. 1979
Hector Daiutolo and Charles R. Grisel Feb. 1981 36 p
(FAA Proj. 082-531-500)
(AD-A096346; FAA-CT-81-1; FAA-RD-80-136) Avail: NTIS HC A03/MF A01 CSCL 01/3

Braking tests were conducted to determine if large aircraft tires with laterally-cut sipes in the tread improve the braking performance on a wet surface. A tire with 1/4-inch deep by 3/16-inch spaced sipes showed improved braking performance over the nonsiped tire when tested on a wet surface. The improvement, however, becomes insignificant when the depth of the sipes is reduced to 1/8-inch, and there is no improvement when standing water is present regardless of the sipe depth. GRA

N81-21358# Naval Ship Research and Development Center, Annapolis, Md. Materials Engineering Dept.
INFRARED TEMPERATURE SENSING OF COOLING RATES FOR ARC WELDING CONTROL
W. E. Lukens, R. A. Morris, and E. C. Dunn Feb. 1981 35 p refs
(ZR00001)
(AD-A096049; DTNSRDC/SME-80/70) Avail: NTIS HC A03/MF A01 CSCL 13/8

It is known that the weld metal mechanical properties of quenched and tempered steels are dependent upon cooling rate, which is presently indirectly controlled by specification of heat input. A method to directly control weld metal cooling rate would result in more consistency in achieving required mechanical properties. In the present investigation the use of commercial infrared sensing equipment was explored as a means of real-time monitoring of weld metal cooling rate. Infrared equipment has a distinct advantage over other temperature detecting systems in that it requires no physical contact with the work, thus affording a minimum amount of interference with the welding process, and is therefore a potentially useful detector for an adaptive feedback welding control system based on cooling rate. It was found that infrared thermography appears to offer considerable promise for welding control by providing weld metal cooling rates which are: (1) reproducible, (2) sensitive to variations in welding conditions, and (3) relatable to cooling rates as measured by plunged thermocouples. GRA

N81-21359# Alabama Univ., Huntsville. Kenneth F. Johnson Environmental and Energy Center.
CHANGE-OF-PACE ELECTRIC AUTOMOBILE USER DEMONSTRATION (COMCAR 2) Final Report
K. E. Johnson Nov. 1980 75 p
(Contract EC-77-X-01-3559)
(DOE/TIC-11373) Avail: NTIS HC A04/MF A01

A present technology electric car was tested under conditions which were as close as possible to real life conditions as opposed to the laboratory conditions encountered on the dynamometer or the test track. The test program was conducted over several months, so that the data would realistically reflect the performance characteristics of the car under urban driving conditions. In addition to demonstrating the change of pace, the ComCar 2 project was expected to make contributions toward product improvement. Engineering evaluations of car components were performed in close cooperation with the manufacturer, in an effort to help solve several technical problems which were encountered. Information was obtained and is presented on vehicle performance, operating costs, drivers' responses to electric vehicles, and the support structures need to operate and maintain electric vehicles. DOE

N81-21360# Akron Univ., Ohio. Dept. of Mechanical Engineering.
INVESTIGATION OF FIELD TEST PROCEDURES FOR LARGE FANS Final Report
P. M. Gerhart and M. J. Dorsey Dec. 1980 103 p refs
(EPRI Proj. 1649-5)
(EPRI-CS-1651) Avail: NTIS HC A06/MF A01

An accepted procedure for field testing of large fans of the type used to provide mechanical draft in fossil fired steam generating units is discussed. A fan test code is nearing completion. In order to insure that the test code methods are accurate and practicable and in order to evaluate the feasibility of relatively advanced velocity probes and electronic instrumentation, extensive field tests of two power plant fans were carried out. An acceptable procedure for field testing large fans was developed. Procedures used and the results of the field tests are described. DOE

N81-21361# Department of Energy, Morgantown, W. Va. Energy Systems Planning Div.
EVERLASTING SLIDING-DISC VALVE METC SOA TEST VALVE NO. B-3, STATE-OF-THE-ART LOCKHOPPER VALVE TESTING AND DEVELOPMENT PROJECT

J. F. Gardner, R. C. Hall, R. G. Hornbeck, R. A. Griffith, T. M. Yost, D. M. Harvey, W. E. Galvin (EG/G, Morgantown, W. Va.), T. R. Gayheart (EG/G, Morgantown, W. Va.), and S. K. Kapur (TRW, Denver) Aug. 1980 42 p refs
(Contracts DE-AM21-80MC-15422; DE-AT21-80MC-14689)
(DOE/METC-SP-80/17) Avail: NTIS HC A03/MF A01

The Everlasting Sliding-Disc Value accumulated 740 valve cycles in the valve static test unit and over 16,000 valve cycles in the valve dynamic test unit. Only minor operating problems, primarily erratic motion and some scoring of the seating surface, were encountered with coarse limestone (5/16 x 1/8 in) particles. Operation with fine solids (100 mesh limestone) showed excellent performance. The actuator level arm failed twice but a change in clearances solved the problem. Based on its performance in testing, the sliding disc valve, with minor modifications, is a very promising choice for feedside lockhopper service in coal conversion and utilization. DOE

N81-21362# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.
ELECTRON BEAM WELDING OF 8-INCH 2-1/4 Cr-1 Mo Final Report
Charles M. Weber Aug. 1980 173 p
(Contract DE-AC05-77OR-10244)
(DOE/OR-10244-10) Avail: NTIS HC A08/MF A01

Electron beam welding procedures were developed and used to make sound welds in 8-inch thick 2-1/4 Cr-1 Mo in the horizontal position. A two-pass technique, one pass from each side, was developed for welding the 8-inch thickness. Techniques for eliminating various weld defects were developed. It was learned that the beam oscillation conditions strongly influenced welding performance. Procedures were developed for hard and soft vacuum operation, but hard vacuum was preferred. Procedures for starting and stopping the welding sequence were developed, along with a repair technique involving re-welding over a plug filled hole. The joint fit-up requirements were determined: a joint mismatch of 3/4 in. was welded, and a joint gap opening of 0.100 in. was welded without alteration of the welding procedure. It was shown that it is not necessary to demagnetize the material for successful welding, but that a special magnetic shield may be needed to protect the electron beam from stray magnetic fields. DOE

N81-21363# Colorado School of Mines, Golden. Dept. of Metallurgical Engineering.
CHARACTERIZING AND IMPROVING THE TOUGHNESS OF THICK-SECTIONED 2-1/4 Cr-1 Mo ELECTROSLAG WELDMENTS Quarterly Report, Oct. - Dec. 1980
Glen R. Edwards and Robert H. Frost 1980 23 p
(Contract DE-AS05-78ET-12313)
(DOE/ET-12313-T2) Avail: NTIS HC A02/MF A01

Effects of electrochemical reactions on electroslag welds of 2-1/4 Cr-1 Mo steel were evaluated using a CaF2-10% Al2O3 flux. Results indicate that a major fraction of the chemical modification observed in the dc electroslag welding process can be attributed to electrochemical reactions, which offer the possibility for enhanced control of the chemistry of the fusion zone. DOE

N81-21364# Oak Ridge Y-12 Plant, Tenn. Nuclear Div.
DIGITALLY BASED PATTERN GENERATOR FOR AN ELECTRON-BEAM WELDER M.S. Thesis
L. G. Whitten, III 19 Feb. 1981 62 p refs
(Contract W-7405-eng-26)
(Y-2211) Avail: NTIS HC A04/MF A01

Up to seven patterns of any shape are stored in programmable read-only memory! (PROM). The pattern resolution is 39% at frequencies from 10 Hz to 1 KHz and can be x-t, y-tm or x-y formed. Frequency and pattern selection may be chosen by the welder computer or manually selected on the front panel. The ability to repeatedly synchronize two waveforms of any shape and frequency enables an unlimited variety of welds. DOE

N81-21365# Los Alamos Scientific Lab., N. Mex.
GREASELESS, HIGH-TEMPERATURE VACUUM SEALS FOR THE ZT-40
Stephen E. Newfield, Roscoe A. Faussone, Larry R. Ebaugh, and Gary D. Carter 1980 11 p Sponsored by DOE
(LA-8549) Avail: NTIS HC A02/MF A01

Rubber O rings to be used in the plasma containment vessel of the ZT-40 torus were molded and tested for their sealing ability. To meet the stringent requirements for these parts, the mold design and mold surface preparation should adhere strictly to the Viton manufacturer's recommendation. In addition, the molding stock must be worked either by injection molding or by a preprocess such as extrusion. S.F.

N81-21366# Kloeckner-Humboldt-Deutz A.G., Cologne (West Germany).
INVESTIGATION INTO THE ENERGY CONSUMED IN COOLING A HIGH PERFORMANCE DIESEL ENGINE AND THE WAY IT CAN BE REDUCED, ESPECIALLY BY HEAT INSULATION
W. Kleinschmidt and W. Rodenbach Bonn Bundesmininster der Verteidigung 1980 130 p refs In GERMAN; ENGLISH summary Sponsored by Bundesminister der Verteidigung
(BMVg-FBWT-80-2) Avail: NTIS HC A07/MF A01

The effects of improved heat insulation on engine operation, cycle characteristics, combustion and cooling were investigated. Results indicate that maximum reduction in fuel consumption of 6.5% can be achieved with an ideal insulation; this figure can be improved to about 10% with turbo or Rankine Hybrid engines. However the heat insulation that can be realized in practice together with the combustion difficulties encountered renders this type of engine noncompetitive. Predictions on the thermal loads, fuel consumption and heat rejection associated with highly turbocharged engines are given. Author (ESA)

N81-21367# Institut fuer Angewandte Materialforschung der Fraunhoffer-Gesellschaft e. V., Bremen (West Germany).
INVESTIGATIONS INTO THE WELDABILITY OF ULTRA-HIGH STRENGTH AUSFORMED STEEL X41CrMoV51
R. Fleer Bonn Bundesminister der Verteidigung 1980 108 p refs In GERMAN; ENGLISH summary Sponsored by Bundesminister der Verteidigung
(BMVg-FBWT-80-3) Avail: NTIS HC A06/MF A01

The changes in structure of ultrahigh strength ausformed steel X 41 CrMoV 51 due to plasma welding were investigated. Plasma welds were compared with electron beam welds. It is shown that without post heat treatment, fracture occurs in the dendritic weld seam. Fracture behavior is influenced by small ferritic seams, located between hard martensitic dendrites. After a post weld heat treatment in the same manner as that of the unaffected material, fracture takes place within the heat affected zone. It is also shown that in this zone a coarsening of the carbides occurs together with a rebuilding of the dislocation structure. Author (ESA)

N81-21368# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Stabilisation-Systemes.
MAGNETIC BEARING MOMENTUM WHEEL DYNAMIC TESTS
M. Burello and L. Torres 6 Jul. 1979 68 p refs
(CNES-79/CT/PRT/SST/SS/014) Avail: NTIS HC A04/MF A01

A magnetic bearing momentum wheel (MBMW) was tested on a three axis air bearing simulator. The static and dynamic characteristics of the actuator equipment were measured. Tests covered the command electronics, motor, rotor, magnetic bearings, and backup ball bearings. The MBMW was then integrated into a partially simulated attitude control system with dynamic and functional conditions as close as possible to those encountered in a real satellite system. The MBMW assembly was examined in an attitude control loop for the normal operational mode. Modeling and simplified analysis of control are presented, including obtainable digital resolution for the characteristics equation. Results show satisfactory coherence between digital simulation and experimentation, validating the use of this control model and experimental setup for testing the MBMW in other operational modes. Author (ESA)

N81-21369# European Space Agency, Paris (France).
DESIGN AND INVESTIGATION OF STATIC PRESSURE COMPRESSOR CASCADES BEHIND IMPULSE ROTORS Ph.D. Thesis - Tech. Hochschule, Aachen
Reinhold Fuchs Nov. 1980 108 p refs Transl. into ENGLISH

of 'Auslegung u. Untersuchung von Verdichtergittern zur statischen Druckerzeugung Hinter Ueberschallimpulslaufraedern' DFVLR, Cologne Report DFVLR-FB-79-11, Mar. 1979 Original report in GERMAN previously announced as N80-22353
(ESA-TT-629; DFVLR-FB-79-17) Avail: NTIS HC A06/MF A01

The design, optimization and testing of two dimensional cascades for a supersonic compressor stage with an impulse rotor are described. These cascades represent possible sections of stator blading operating behind an impulse rotor. The purpose of the cascade is to decelerate the supersonic rotor exit flow with velocity of about M = 2 to subsonic velocity by means of a system of multiple shocks, and to realize a high static pressure. Multiple shock cascades with and without flow deflection are tested in a cascade wind tunnel and, in some cases, compared with theoretical calculations. Stabilization of the shock system in the cascade and static pressure ratios of about six with entry flow Mach numbers around 2.2 were achieved. Author (ESA)

N81-21370# Texas Univ. at Arlington. Coll. of Engineering.
RESISTANCE WELDING WITH HOMOPOLAR GENERATORS Final Report
Robert E. Keith, Robert B. Flautt, and William F. Weldon Sep. 1980 342 p refs
(Grant NSF DAR-77-23874)
(PB81-137846; NSF/RA-800186) Avail: NTIS HC A15/MF A01 CSCL 13H

The applicability of high power homopolar generator resistance welding to a variety of engineering alloys in frequently used shapes is evaluated. Upset butt type welds were made in 19 different alloys and five dissimilar metal couples. To produce the welds, a welding fixture was designed and built. Generator variables studied were rotor speed and field excitation current. Fixture variables included upset force and the time of its application. Specimen variables included the material and joint design. Weld evaluations were based on metallography, microhardness traverses, and tensile tests. A finite difference mathematical model of a homopolar pulse resistance weld was used to interpret results. GRA

N81-21371# Environmental Protection Agency, Ann Arbor, Mich. Test and Evaluation Branch.
EMISSIONS AND FUEL ECONOMY OF A COMPREX PRESSURE WAVE SUPERCHARGED DIESEL
Edward Anthony Barth and Richard N. Burgenson Oct. 1980 10 p refs
(PB81-133399; EPA-AA-TEB-81-1) Avail: NTIS HC A02/MF A01 CSCL 21E

In order to increase public interest in vehicles equipped with diesel engines, methods of improving diesel fueled engine performance, as compared to current gasoline fueled counterparts, are investigated. One method to increase performance is to supercharge or turbocharge the engine. An EPA assessment of a supercharging technique previously evaluated is described. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-21372# Aerojet Liquid Rocket Co., Sacramento, Calif.
STORABILITY INVESTIGATIONS OF WATER, STORAGE EVALUATION AFTER SEVEN YEARS Annual Progress Report, Nov. 1979 - Oct. 1980
E. M. VanderWall and G. R. Janser Dec. 1980 57 p
(Contract F04611-72-C-0062; AF Proj. 3059)
(AD-A096033; AFRPL-TR-80-71; ARP-5) Avail: NTIS HC A04/MF A01 CSCL 13/4

The objective of this program is to gather data that will permit the Air Force to assess the long-term storage characteristics of water, particularly with regard to formation of particulate matter, so that the feasibility of long-term storage of water for use as a transpiration coolant can be determined. Five metallic materials of construction are included in the program: 304 stainless steel; A-286 (aged) steel, 17 4-PH (aged) stainless steel; Inconel 718 (aged); 6Al-4V titanium (STA). Two types of water are used in the program: (1) oxygen-saturated, deionized, filtered, and (2) oxygen-free, deionized, filtered. Using the filtered, deionized waters, ten-year storage tests have been initiated in 304 and 17-4PH stainless steel, A-286 (aged) steel, Inconel 718 (aged) and 6Al-4V titanium (STA) containers. Evaluation of water and containers stored for seven years has been completed. The data show that both oxygen-saturated and oxygen-free water can be stored in appropriate metal containers for the selected time periods without detrimental particulate matter formation or significant changes in the quality of the water. It is in excellent condition for transpiration coolant purposes. GRA

N81-21373# National Bureau of Standards, Washington, D.C. National Measurement Lab.
TECHNICAL ACTIVITIES. OFFICE OF NONDESTRUCTIVE EVALUATION
Harold Berger and Leonard Mordfin Nov. 1980 120 p refs
(PB81-132466; NBSIR-80-2162) Avail: NTIS HC A06/MF A01 CSCL 14B

A review of nondestructive evaluation programs, for FY 1980 is presented. Included are: acoustic emission calibration; eddy current conductivity; ultrasonic testing; and radiography. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-21374# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 13, NO. 2
Judith Nagle-Eshleman, ed. Feb. 1981 90 p refs
(AD-A096244-Vol-13-No-2) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20/11

Technology developments in the fields of sound, shock, and vibration are considered. Specifically, vibration of highway bridges and modeling techniques applicable to underwater acoustics are discussed. Approximately 165 abstracted citations from the current literature are presented. Topics covered include: mechanical systems, components, and properties; structural systems and components; vehicle systems; biological systems; electric components; experimentation; and analysis and design. For individual titles, see N81-10367.

N81-21375# Mar, Inc., Rockville, Md.
UNDERWATER ACOUSTIC MODELING TECHNIQUES c71
P. C. Etter *In* Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 13, No. 2 Feb. 1981 p 11-20 refs (For primary document see N81-21374 12-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20/11

A state-of-the-art literature review of underwater acoustic models developed by the Navy sonar modeling community is presented. Three types of acoustic models are addressed: propagation loss, noise, and active sonar/reverberation models. Basic features of each type of model and areas of application are discussed. Problems associated with model evaluation and validation are described. J.M.S.

N81-21376*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF EMERGENCY-LOCATOR-TRANSMITTER PERFORMANCE IN REAL AND SIMULATED CRASH TESTS
Huey D. Carden Apr. 1981 32 p refs Presented at the 1980 Aircraft Safety and Operating Probl. Conf., Hampton, Va.,

5-7 Nov. 1980
(NASA-TM-81960; L-14431) Avail: NTIS HC A03/MF A01 CSCL 01C

Emergency locator transmitter (ELT) activation problems were investigated by testing a sampling of ELT units in actual crashes and in a special test apparatus which simulated longitudinal crash pulses with superimposed local structural resonances. The probable causes of excessive false alarms and nonactivation of ELT's during crash situations were determined. Solutions to operational and technical problems were also examined as well as the sensitivity of ELT impact switches to orientation and to local structural vibrations. R.C.T.

N81-21377# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
STRUCTURAL INELASTICITY. 26: BEAMPLT: A PROGRAM FOR FINDING THE YIELD-POINT LOAD OF TRANSVERSELY LOADED RECTANGULAR GRIDS
Patrick Tait and Philip G. Hodge, Jr. Jan. 1981 25 p refs
(Contract N00014-75-C-0177; NR Proj. 064-429)
(AD-A096282; AEM-H1-26) Avail: NTIS HC A02/MF A01 CSCL 12/1

An interactive computer program for finding the yield-point load of a transversely loaded rectangular grid is described. The maximum statically-admissible multiplier and an associated moment distribution are found by Linear Programming. GRA

N81-21378# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
A NONLINEAR EFFECT IN MODE 2 CRACK PROBLEMS
James K. Knowles Jan. 1981 21 p refs
(Contract N00014-75-C-0196)
(AD-A096247; TR-47) Avail: NTIS HC A02/MF A01 CSCL 12/1

A recent result of Stephenson shows that, when finite deformations are taken into account, a crack under Mode II loading conditions in plane strain will open, at least near the crack-tip and at least for certain elastic materials. In this note, the matter is investigated further, and it is shown that, in general, nonlinear effects - even at small loads - lead either to crack-opening or apparent interpenetration of the crack-faces when the loading is of Mode II-type. GRA

N81-21379# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon System Lab.
RESIDUAL STRESS REDISTRIBUTION CAUSED BY NOTCHES AND CRACKS IN A PARTIALLY AUTOFRETTAGED TUBE
S. L. Pu and M. A. Hussain Jan. 1981 28 p refs Submitted for publication
(DA Proj. 1L1-61102-AH-60)
(AD-A096193; AD-E440109; ARLCS-TR-81005) Avail: NTIS HC A03/MF A01 CSCL 20/11

A simple method is provided for the computation of the redistribution of residual stresses and the stress intensity factors due to the introduction of notches and cracks in a partially autofrettaged tube. Numerical results of several crack and notch problems are obtained by the method of thermal simulation. These results are shown to be in excellent agreement with those obtained from the classical method of superposition. The new method based on thermal simulation is easier to apply and it avoids the singular stresses near the crack tip when the distribution crack face loading is used in the method of superposition. GRA

N81-21380# Rensselaer Polytechnic Inst., Troy, N. Y.
THE RELATIONSHIP OF STRUCTURE AND PROPERTIES TO DEPOSITION CONDITIONS AND THE ORIGIN OF RESIDUAL STRESS IN CVD SILICON CARBIDE AND NITRIDE Final Report, 10 Jun. 1977 - 31 Dec. 1979
R. J. Diefendorf, J. L. Benjamin, and W. A. Magee 13 Feb. 1981 59 p refs
(Grant DAAG29-77-G-0167)
(AD-A096031; ARO-14380.1-MS) Avail: NTIS HC A04/MF A01 CSCL 13/8

Two limiting factors in the acceptance of CVD SiC as a structural material have been deposition control and residual stress in the deposit. Deposition parameters have been related to morphological as well as crystallographic structures. The effect of various additions to the basic methyltrichlorosilane and hydrogen deposition gases has also been studied and the effect on structure noted. Deposition rate control through the interaction of these parameters has also been obtained. Residual stresses large enough to crack deposits have been observed. Although no quantitative model has been determined to predict these stresses, a qualitative model has been proposed which allows the trends in residual stress to be predicted. This model is based on structure. Finally, the strength of CVD SiC was determined using a biaxial tensile test to obtain a closer approximation of the as-deposited strength than is possible with three or four-point bend tests. GRA

N81-21381# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
THERMO-MECHANICAL AND THERMAL BEHAVIOR OF HIGH-TEMPERATURE STRUCTURAL MATERIALS Interim Report, 1 Jan. - 31 Dec. 1980
D. P. H. Hasselman, L. D. Bentsen, N. Claussen, M. P. Kamat, K. Niihara, K. Satyamurthy, C. Shih, J. P. Singh, J. R. Thomas, Y. Tree et al 31 Dec. 1980 211 p refs
(Contract N00014-78-C-0431)
(AD-A096010) Avail: NTIS HC A10/MF A01 CSCL 11/2

This report contains studies, completed over the period from 1/1/80 to 12/31/80 as part of a research program on the thermo-mechanical and thermal behavior of high-temperature structural materials, in the form of individual chapters as follows: Effect of Bath and Specimen Temperature on the Thermal Stress Resistance of Brittle Ceramics Subjected to Thermal Quenching; Improvement of Thermal Shock Resistance of Brittle Structural Ceramics by a Dispersed Phase of Zirconia; Effect of Phase Composition and Microstructure on the Thermal Diffusivity of Silicon Nitride; Orientation Effects on the Thermal Diffusivity of Hot-Pressed Silicon Nitride; Observations on the Sub-Critical Growth and Healing of Micro-cracks in Brittle Ceramics; Thermal Stresses in Partially Absorbing Flat Plate Symmetrically Heated by Thermal Radiation and Cooled by Convection; Analysis of Thermal Stress Resistance of Partially Absorbing Ceramic Plate Subjected to Asymmetric Radiation, II, Convective Cooling at Front Surface; Effect of Nature of Concavity of Temperature Distribution on Position and Sign of Maximum Thermal Stress; Effect of Crack Interaction on the Fracture Initiation and Crack Propagation in Brittle Ceramics Subjected to Severe Thermal Shock; Reviews and Books. GRA

N81-21382# Naval Postgraduate School, Monterey, Calif.
PHOTOELASTIC STUDY OF ELASTIC AND PLASTIC STRESS FIELDS IN THE VICINITY OF A NOTCH M.S. Thesis
Frank E. Stenstrom Dec. 1980 84 p refs
(AD-A096295) Avail: NTIS HC A05/MF A01 CSCL 11/6

The ability to calculate stresses in critical areas by measuring strains at far-field locations will be essential to the success of new fatigue monitoring equipment currently being developed. In this thesis the photoelastic method was utilized to study plastic zone characteristics and residual compressive stresses in critical areas modeled by notched specimens. Data reduction methods for photoelastic measurements were developed by a thorough investigation of reinforcement effects and by a careful determination of material properties of PS-1C Photoelastic Material and 7075-T6 aluminum. A modified Ramberg-Osgood data reduction method was developed for determining stresses from strains measured in the plastic region. Stresses obtained from slip-line theory for rigid-perfectly-plastic material were compared to the experimental results, and differences noted. Notch tip stresses and strains were compared to predictions using Neuber's relation. The measured data indicated stress concentrations 20.9% lower than predicted by Neuber. GRA

N81-21383# Illinois Inst. of Tech., Chicago. Dept. of Metallurgical and Materials Engineering.
THE MECHANISMS OF CRACK INITIATION AND CRACK PROPAGATION IN METAL-INDUCED EMBRITTLEMENT OF METALS. PART 1: DELAYED FAILURE IN THE EMBRITTLEMENT OF 4140 STEEL BY INDIUM Technical Report, 1 Jun. 1979 - 31 Dec. 1980
Paul Gordon 12 Dec. 1980 37 p refs
(Contract N00014-79-C-0580; Grants NSF DMR-79-08674;

NSF DMR-77-04272)
(AD-A096228) Avail: NTIS HC A03/MF A01 CSCL 11/6

Metal-induced embrittlement of 4140 steel by indium was studied using delayed failure tensile tests. The temperature and stress dependence of the kinetics of crack initiation and crack propagation in both liquid metal induced and solid metal induced cracking were examined in the same system using electrical potential drop measurements along the indium covered portion of the same gage length to record the start and progress of cracking. Fractographic observation was also used. Experimental results are presented and their implications with regard to crack propagation are discussed. GRA

N81-21384# Illinois Inst. of Tech., Chicago. Dept. of Metallurgical and Materials Engineering.

THE MECHANISMS OF CRACK INITIATION AND CRACK PROPAGATION IN METAL-INDUCED EMBRITTLEMENT OF METALS. PART 2: THEORETICAL ASPECTS OF CRACK INITIATION

Paul Gordon 1 Feb. 1981 22 p refs
(Contract N00014-79-C-0580; Grant NSF DMR-79-08674)
(AD-A096231) Avail: NTIS HC A02/MF A01 CSCL 11/6

Various mechanisms proposed in the literature for crack initiation are evaluated in the light of the results of delayed failure tensile tests conducted on both liquid-metal induced and solid-metal induced cracking of s 4140 steel by indium. It is concluded that additional data is needed on the solubilities, diffusion rates, and interfacial energies involved. GRA

N81-21385# Westinghouse Research and Development Center, Pittsburgh, Pa. Structural Behavior of Materials Dept.

APPLICATION OF ADVANCED FRACTURE MECHANICS TECHNOLOGY TO ENSURE STRUCTURAL RELIABILITY IN CRITICAL TITANIUM STRUCTURES Interim Report, 1 Jun. - 20 Nov. 1980

Hugo A. Ernst, John D. Landes, and Edward T. Wessel 20 Nov. 1980 14 p refs
(Contract N00014-80-C-0655)
(AD-A096227; Rept-80-9D3-TINAV-R1) Avail: NTIS HC A02/MF A01 CSCL 11/6

Numerous meetings were held with Navy personnel in order to identify areas of concern and the experimental data needed for the structural analysis. The mentioned areas cover a broad spectrum regarding loading conditions, material behavior, fabrication procedures, weldments and structural integrity. It is anticipated that recommendations will be made regarding data gathering and/or critical tests for specific needs. GRA

N81-21386# California Univ., Livermore. Lawrence Livermore Lab. Engineering Research Div.

APPLICATION OF A LARGE SCALE STATE ESTIMATOR TO THE VIBRATIONAL RESPONSE OF A MECHANICAL STRUCTURE

Darrel L. Lager 18 Sep. 1980 41 p refs
(Contract W-7405-eng-48)
(UCID-18824) Avail: NTIS HC A03/MF A01

The SEALS (State Estimator for Large Systems) computer code was applied to the estimation of displacement time histories of points on a vibrating mechanical structure given noisy measurements at two locations on the structure. The goal was to demonstrate the feasibility of determining the motion of internal members of the structure given only noisy measurements from the exterior and a finite element model of the structure. The model was developed from the geometry of the structure using the ZONE finite element mesh generator to produce an axisymmetric finite element model consisting of 15 elements and 32 nodes. The SAP4 code was used to translate the geometry and material properties into a 2nd order matrix differential equation (with matrices of size 87 by 87) which was then transformed into 174 state space equations (i.e., first order differential equations) for input to the SEALS state estimation code. A model check feature of SEALS was used to simulate displacement time histories at all the nodes of the finite element model given an initial displacement for one of the nodes. DOE

N81-21387# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.

TIME STEP DEPENDENCE OF CREEP CALCULATIONS

Dale S. Preece 1981 20 p refs
(Contract DE-AC09-76DP-00789)
(SAND-80-2691) Avail: NTIS HC A02/MF A01

Creep calculations in support of the Strategic Petroleum Reserves require the use of an incremental solution with respect to time. The creep algorithms use a time step supplied by the user. Larger time steps may give erroneous results even though the computer solution is stable. The theory behind such problems is presented and some examples showing several different solutions obtained where all circumstances were identical except the size of the time step are given. Author

N81-21388# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. RV/SA.

SMM-HXIS, MIES-PFM: VIBRATION TEST REPORT ON STRUCTURAL MATTERS AND APPLIED TEST LEVELS

C. Blaas Feb. 1979 42 p refs
(FOK-RV-79-17) Avail: NTIS HC A03/MF A01

The structural integrity and the internal and overall alignment stability of the PFM were demonstrated in withstanding protoflight level sinusoidal vibration in three axes, with no evidence of loss of alignment accuracy for any relevant part of the structure. The first resonant frequency of the structure is proved to be 43 Hz for excitation in X and Z direction; for excitation in Y direction the frequency results are unclear. Response acceleration values are obtained on the MPCS dummy unit for use in unit vibration testing. Author (ESA)

N81-21389# Societe pour le Perfectionnement des Materiels et Equipements Aerospatiaux, Toulouse (France). Lab. SOP-EMEA.

REPORT ON THE VIBRATION TESTING OF THE METEOSAT CONICAL SHROUDING [COMPTE RENDU D'EXECUTION D'ESSAIS DE VIBRATIONS. SPECIMEN: VIROLE CONIQUE METEOSAT]

J. Boulzaguet 11 Sep. 1980 617 p In FRENCH
(LT-19166) Avail: NTIS HC A99/MF A01

The qualification of a fully equipped conical shrouding specimen in a vibratory environment is described. A 170 kN electrodynamic vibration test apparatus, with numerical command console, along with assorted data acquisition and processing stations for the parameterization of the mechanical environment were used. The test procedure, including specimen reference orientation, specimen configuration, and setup, is depicted. Test results are given as shock spectra for the specimen response along the X and Z axes. Author (ESA)

N81-21390# Defence Research Information Centre, Orpington (England).

COMPARISON OF DIFFERENT THIN WALL, FILAMENT WOUND, SHELL SHAPES OF ROTATION DESIGNED IN RESPECT OF CRACK FORMATION

R. Foerster and G. Kraft Oct. 1980 27 p refs Transl. into ENGLISH from Kunststoffe (West Germany), v. 62, no. 9, 1972 p 587-591
(DRIC-Trans-6247; BR76581) Avail: NTIS HC A03/MF A01

Filament wound, rotation molded, shells having differing shell forms but similar size and wall thickness were compared for tolerable internal pressure up to the limit of crack formation. The shell forms used were calculated by the theory of meshes and continuity theory with uniformly distributed strain in both the meridional and circumferential directions, together with forms calculated by continuity theory for optimum crack prevention. It is shown that latter shell forms have simultaneous crack formation over the whole shell, and are considered the optimum design for crack prevention. Author (ESA)

N81-21391# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

ADDITIONAL INFORMATION ABOUT FIGHTER AIRCRAFT LOADING STANDARD FOR FATIGUE EVALUATION (FALSTAFF)

J. B. deJonge 12 Jun. 1979 13 p refs
(NLR-TR-79056-U) Avail: NTIS HC A02/MF A01

The complete Markov matrix, plus tabulations and level crossings pertaining to the FALSTAFF sequence are presented. This provides a means for checking whether algorithms programmed for specific process computers generate this standard

load sequence for the load time history in the lower wing skin near the wing root. The essential properties of the load sequence are summarized along with a method for checking the correctness of an installed FALSTAFF generator, using its successive load transitions. Author (ESA)

N81-21392# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

AGARD CRITICALLY LOADED HOLE TECHNOLOGY. TEST RESULTS OBTAINED IN THE NETHERLANDS

H. H. vanderLinden and A. E. Meulman Nov. 1979 55 p refs Sponsored by Research Branch of the Directorate of Materiel Air (RNLAF)

(NLR-TR-79124-U) Avail: NTIS HC A04/MF A01

Tensile and fatigue tests were conducted on simple notched, open hole specimens and ASTM E8-69 specimens of 7050-T76 aluminum alloy. The tests were conducted to determine if differences in data obtained by different laboratories were real or due to errors. The FALSTAFF load sequence was used for the fatigue tests. Findings include: (1) the number of flights to crack initiation of the open hole specimens can be determined successfully using a strain gage-based detection system; (2) open hole specimen crack propagation life from a crack, which is smaller than 1 mm inside the hole, to failure is about 20% of the total life; and (3) the difference in life between the high quality hole/hilok joint (4842 flights) and the low quality hole/hilok joint (2812 flights) is caused by difference in hole quality and fit. Author (ESA)

N81-21393# Oxford Univ. (England). Dept. of Engineering Science.

TESTING TECHNIQUES AT HIGH RATES OF STRAIN

J. Harding Mar. 1980 27 p refs

(OUEL-1308/80) Avail: NTIS HC A03/MF A01

Techniques for studying the mechanical behavior of materials at high rates of strain are reviewed and typical results obtained by the use of these techniques are presented. At intermediate rates of strain from 1 to 100/s, where the effects of wave propagation do not have to be taken into account, hydraulically operated loading machines for both uniaxial and combined stress tests are described. For testing at the higher rates associated with impact loading, i.e., in the range 500 to 5000/s, the standard split Hopkinson pressure bar (SHPB) apparatus which involves stress wave loading is commonly used. The compression version of this apparatus and subsequent modifications for tension and torsion testing are fully described. The application of the SHPS to testing under biaxial stress, to the study of fracture dynamics, and to tests in which the specimen is subjected to a varying strain rate is then discussed and some of the attempts which have been made to adapt the SHPB technique to allow testing at strain rates in excess of 10,000/s are described. Author (ESA)

N81-21394# Oxford Univ. (England). Dept. of Engineering Science.

A THERMO-PLASTIC SHEAR INSTABILITY CRITERION APPLIED TO SURFACE CRACKING IN UPSETTING AND RELATED PROCESSES

Andrew Jenner, Yilong Bai, and Bradley Dodd May 1980 19 p refs

(OUEL-1317/80) Avail: NTIS HC A02/MF A01

Free surface cracks occurring in upsetting are used to study the application of the criterion to ductile fracture under a combined state of stress. Some possible modes of shear instability are described; one of the modes is shown to coincide with the experimentally determined straight-line fracture condition. The shear instability criterion links Lee's observation of strain perturbation (D epsilon sub Z=0) just prior to fracture with the linear fracture condition first found by Kudo. Author (ESA)

N81-21395# Oxford Univ. (England). Dept. of Engineering Science.

THE JOINT EXTREME PROBABILITY APPROACH TO THE WIND LOADING OF STATIC STRUCTURES

S. J. Gumley 1980 127 p refs

(OUEL-1319/80) Avail: NTIS HC A07/MF A01

The joint extreme probability approach as a design method for the wind loading of static structures is reviewed. The approach is possible because of the existence of a spectral gap in the spectrum of horizontal wind speed, giving statistical independence of the meteorological and aerodynamic components of loading. A first order solution to the problem of combining two independent extreme distributions involves the use of a convolution integral method. A complete solution is obtained by developing a higher order Monte Carlo numerical simulation. Analysis of meteorological data suggests that dynamic pressure follows a Weibull parent distribution and a Fisher Tippett Type 1 extreme distribution, which makes plausible its use in existing joint extreme probability methods. The adoption of dynamic pressure as an input variate leads to accurate empirical correlation for joint extreme mode and dispersion given the input meteorological and aerodynamic mode/dispersion ratios. The effect on joint probability calculations of using more or less than the commonly estimated 100 uncorrelated velocity peaks per year was tested statistically. Author (ESA)

N81-21396# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

EXPERIMENTAL STUDIES OF PLATE GIRDERS WITH DIAGONAL STIFFENERS [ETUDE EXPERIMENTALE DE POUTRES A AME PLEINE AVEC RAIDISSEURS DIAGONAUX]

S. Cescotto (Liege Univ.), G. Fonder (Liege Univ.), and R. Redwood (McGill Univ., Sherbrook, Quebec) Sep. 1980 88 p refs In FRENCH Sponsored by Inst. pour l'Encouragement de la Recherche Scientifique dans l'Industrie et l'Agriculture

(CRIF-MT-136) Avail: NTIS HC A05/MF A01

Square panels were tested destructively with a dominant shearing load. Data were obtained concerning the effects of imperfections existing in fabricated girders, such as initial deformation, residual stresses, eccentric loading, and plasticity phenomena. Various forms of stiffener were used. The tests performed on various configurations with different thickness elements are described in detail and the results obtained are given. Results show that the presence of diagonal stiffness leads to a considerable increase in strength. Author (ESA)

N81-21397# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

OLIGOCYCLIC FATIGUE AT HIGH TEMPERATURE: THE MEASURING SYSTEM AND RESULTS FOR 1Cr, 1Mo, 1/4V [FATICA OLIGOCICLICA AD ALTA TEMPERATURA: DESCRIZIONE DELLE APPARECCHIATURE CISE E PRIMI RISULTATI SU ACCACIO 1Cr, 1Mo, 1/4V]

G. Angelino, V. Bicego, and C. Fossati 1980 14 p refs In ITALIAN; ENGLISH summary Presented 8th Natl. Conv. of Assoc. Ital. per l'Anal. delle Sollecitazioni, Florence, 24-27 Sep. 1980 (Contract ENEL-DSR/CISE-ISMAT-700)

(CISE-1607) Avail: NTIS HC A02/MF A01

A laboratory installation with six stations for creep fatigue testing is described. Each station is provided with a 10 ton system and on oven for temperatures up to 700 C with a precision of + or - 0.5 C. A central microprocessor system handles data acquisition and data processing. The results obtained with forged rotor steel at 20 C and 560 C are presented and compared with data from the literature. A life prediction criterion based on energy dissipated through a hysteresis loop, is introduced. Author (ESA)

N81-21398# Bristol Univ. (England). Dept. of Aeronautical Engineering.

THE DYNAMIC STABILITY OF A TETHERED TUBULAR STRUCTURE B.S. Thesis

W. K. Ng Jun. 1980 41 p refs

(BU-248) Avail: NTIS HC A03/MF A01

The dynamic stability of longitudinal oscillations occurring in a tethered underwater tubular structure were investigated. Lagrange equations of motion were developed. Stability criteria were formulated with the aid to Routh's Method. These criteria depended mainly on the hydrodynamic characteristics of the tube, which had to be determined by experiment. These hydrodynamic (aerodynamic) coefficients were determined for a 1/10 scale model in an open jet wind tunnel, for a flow incidence range of 0 to 90 deg. A similar solid circular cylinder was also tested under the same condition as a reference case. Results indicate

that the tubular structure has a higher pitching moment over the entire range than its solid counterpart, while the forces (lift and drag) are substantially the same for the two cylinders.
Author (ESA)

N81-21399# European Space Agency, Paris (France).
MIXED VARIATIONAL PRINCIPLES FOR STATIC PROBLEMS: COUPLING (OF THESE PRINCIPLES) WITH THE DISPLACEMENT PRINCIPLE Ph.D. Thesis - Paris VI Univ
Sophia Chryssafi Feb. 1981 124 p refs Transl. into ENGLISH of "Principes Variationnels Mixtes en Statique: Couplage de ces Principes Avec le Principe des Deplacements", Rept. NT-1980-2 Onera, Paris Original report in FRENCH previously announced as N81-12467
(ESA-TT-664; NT-1980-2) Avail: NTIS HC A06/MF A01

A method of coupling two mixed variational principles with the displacement principle was developed in an attempt to determine the stress distributions in structures having large stress gradients. This method consists of applying a mixed principle in the part of the structure which is likely to experience large stress concentrations, and the displacement method is applied in the remaining part. The finite elements employed are examined, and results relating to cases which were treated numerically are presented. The mixed variational principles allow two or more unknown fields to be obtained simultaneously. Author (ESA)

N81-21400# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE USE OF STANDARDIZED FATIGUE LOAD SEQUENCES IN COUPON AND COMPONENT TESTS
J. B. deJonge 7 Jan. 1980 30 p refs Presented at 2d Ital. Assoc. Aeron. Fatigue (AIFA) Meeting, Naples, 26-28 Feb. 1980
(NLR-MP-80001-U) Avail: NTIS HC A03/MF A01

The required properties of standard load sequences are reviewed. The standard load sequence for transport aircraft wings (TWIST) and the fighter aircraft loading standard (FALSTAFF) are compared and reasons are given for their differences. The uses of standard load sequences for evaluation of material properties, fabrication techniques, structural details (fasteners), spectrum variation effects, and analytical prediction techniques are summarized. Author (ESA)

N81-21401# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A SIMPLE CRACK CLOSURE MODEL FOR PREDICTION OF FATIGUE CRACK GROWTH RATES UNDER VARIABLE AMPLITUDE LOADING
A. U. deKoning Jan. 1980 38 p refs Presented at 13th Natl. Symp. on Fracture Mech., Philadelphia, 16-18 Jun. 1980 (Contract NIVR-1777)
(NLR-MP-80006-U) Avail: NTIS HC A03/MF A01

A model for the prediction of growth rates of fatigue cracks in aluminum alloys is presented. It is based on an approximate description of crack closure behavior and can be used to predict effects of crack growth acceleration and retardation observed experimentally under variable amplitude loading. The model accounts for load interaction effects and for plane strain to plane stress transition. A computer program was developed for analysis of fatigue crack growth, and was used to analyze the effect for certain parameter variations in a flight simulation load spectrum on the crack growth rate. Model predictions of growth rates were in agreement with test data for 7075-T6 thin sheet.
Author (ESA)

N81-21402# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
DYNAMIC ANALYSES OF LIQUID STORAGE TANKS
Medhat Ahmed Haroun Feb. 1980 292 p refs
(Grant NSF PFR-77-23687)
(PB81-123275; EERL-80-04; NSF/RA-800217) Avail: NTIS HC A13/MF A01 CSCL 13D

The dynamic behavior of cylindrical liquid storage tanks was investigated to improve their ability to resist earthquakes. Three phases of research include: a theoretical treatment of the liquid shell system, an investigation of the dynamic characteristics of full scale tanks; and development of an improved design procedure based on an approximate analysis. Natural vibration frequencies and associated mode shapes were found by using a discretization scheme in which the elastic shell is modeled by finite elements and the fluid region is treated as a continuum by boundary solution techniques. A method is presented to compute earthquake response of both circular and irregular tanks based on superposition of the free lateral vibrational modes. GRA

N81-21403# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
COMBINED STIFFNESSES FOR BEAM AND COLUMN BRACES
C. Connor May 1980 32 p refs
(PB81-136236; RR-CE-13) Avail: NTIS HC A03/MF A01 CSCL 13M

An approximate analysis is developed for uniformly loaded members braced at mid-length. The primary member is replaced by a pair of axially loaded flanges, linked by the web in such a way that twist rotations and transverse flange displacements are coupled. The brace has both axial and bending stiffness, the latter being such as to restrain twist rotations of the primary member. Closed form solutions are obtained for critical combinations of axial and bending brace stiffness. The necessary values of axial and bending stiffness are shown to be linked by an equation which is of consistent form for all cases considered.
GRA

N81-21404# Drexel Univ., Philadelphia, Pa. Dept. of Civil Engineering.
FEASIBILITY OF FATIGUE ASSESSMENT OF BLOCK WALLS FROM LABORATORY SCALE METHODS Final Open File Report, Jul. 1978 - Sep. 1979
Robert M. Koerner and Jack L. Rosenfarb Sep. 1980 99 p refs
(Contract DI-BM-JO285013)
(PB81-140139; BM-OFR-144-80) Avail: NTIS HC A05/MF A01 CSCL 13M

The feasibility of using small-scale models to simulate residential masonary foundation walls subject to fatigue loading was investigated. Five wall segments were modeled in one-quarter scale using dynamic similitude equations. The walls were dynamically loaded using a sinusoidal base motion and wall accelerations were monitored. The stiffness, natural frequency response, and damping characteristics were measured. The number of cycles of testing necessary to cause initial visible cracking was recorded. Analysis of the data indicated the importance of the relationship between the forcing function and the natural frequencies of the structure in influencing cracking damage.GRA

N81-21405# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
RELIABILITY CONSIDERATIONS FOR FATIGUE ANALYSIS AND DESIGN OF STRUCTURES
James T. P. Yao Jun. 1980 21 p refs
(Grant NSF PFR-79-06296)
(PB81-140501; CE-STR-80-6; NSF/RA-800206) Avail: NTIS HC A02/MF A01 CSCL 13M

Available literature concerning reliability considerations for fatigue analysis and design of structures is reviewed and summarized. Emphasis is on relatively simple methods with practical applications. Basic formulation of the structural reliability problem involving repeated load applications is described, and several probability distribution functions for fatigue lives with constant cyclic stress are discussed. Use of a linear cumulative damage theorem in structural fatigue is reviewed, and some random and/or full scale fatigue tests are discussed. Reliability aspects of nondestructive inspection and testing procedures are explored together with problem of damage assessment of existing structures. GRA

N81-21406# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
BUCKLING OF PLATES AND SHELLS USING SUB-SPACE ITERATION
J. L. Meek and W. F. C. Tranberg Jul. 1980 36 p refs
(PB81-136012; RR-CE-15) Avail: NTIS HC A03/MF A01 CSCL 20K

The use of superparametric finite elements for the determination of buckling loads for plates and shells was explored. The

geometric stiffness matrix for the shell element was developed and the subspace iteration method was chosen to solve the large scale eigenvalue problem that arises from the formulation. The subspace iteration method was chosen for its versatility in handling large scale problems, but it was found that the standard technique broke down because of the presence of positive and negative eigenvalues. Modification of the method to overcome the problem is described and results are given for comparative studies on the buckling loads of both plates and shells. GRA

N81-21407# Colorado Univ. at Boulder. Dept. of Civil, Environmental, and Architectural Engineering.

APPLICATION OF SCALE-FREE AND DIMENSIONLESS FINITE ELEMENTS Final Technical Report

John O. Dow 1980 172 p refs

(Grant NSF PFR-78-23078)

(PB81-140691; NSF/RA-800283) Avail: NTIS HC A08/MF A01 CSCL 20K

The finite element method is used to generate highly refined finite elements numerically. These elements are directly applicable to the analysis of general structures or for use in modeling special structures such as stress concentrations. Side free and dimensionally independent finite elements are developed including general rectangular, triangular, and three dimensional elements. Recursively generated square composite elements and the four node quadrilateral element generated from the assembly of four scale free triangular elements also are developed. Various characteristics of scale free refined elements and standard finite elements are compared to highlight the relative merits of these elements. Developments used in generating scale free refined stress concentration elements are described. Also, generation of a refined element for the case of a square shear panel with a central circular hole is illustrated. GRA

N81-21408# Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.

THE SOLUTION OF FORCED VIBRATION PROBLEMS BY THE FINITE INTEGRAL METHOD

P. Swannell Aug. 1980 55 p refs

(PB81-136319; RR-CE-16) Avail: NTIS HC A04/MF A01 CSCL 20K

The finite integral method is a numerical method of solving simultaneous differential equations. The technique and solution of some forced vibration problems are examined. Examples 1, 2 and 3 are simple applications designed to illustrate the formulation and to draw comparisons with 'exact' classical approaches. A detailed formulation of a more substantial vibration problem involving the modelling of a 'rolling load' system and the girder which supports it is included. GRA

42 GEOSCIENCES (GENERAL)

N81-21409*# National Aeronautics and Space Administration, Washington, D. C.

EARTH STUDY FROM SPACE

A. V. Sidorenko Apr. 1981 20 p Transl. into ENGLISH from Prir., (USSR), no. 11, Nov. 1980 p 3-9 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by USSR Academy of Sciences (USSR)

(Contract NASw-3198)

(NASA-TM-76486) Avail: NTIS HC A02/MF A01 CSCL 08F

The significance that space studies are making to all Earth sciences in the areas of geography, geodesy, cartography, geology, meteorology, oceanology, agronomy, and ecology is discussed. It is predicted that cosmonautics will result in a revolution in science and technology. A.R.H.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-21410*# Calspan Advanced Technology Center, Buffalo, N.Y.

APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 Aug. - 23 Nov. 1980

23 Nov. 1980 7 p HCMM

(Contract NAS5-24263)

(E81-10079; NASA-CR-163777; QR-13) Avail: NTIS HC A02/MF A01 CSCL 05B

The thermal properties of Lake Ontario as they relate to water equality, lake hydrology and energy exchange were investigated as well as the urban heat island problem in selected areas adjacent to the lake. The HCMM thermal sensor was fully calibrated for several underflight data. Actual surface water temperature maps were generated for all of Lake Ontario using the calibration procedure developed. Major water quality changes associated with the thermal bar as located by HCMM thermal data were observed from satellite and aerial data and verified by ground truth. A.R.H.

N81-21411*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.

MONITORING DROUGHT IMPACT FROM LANDSAT

Eugene L. Maxwell, R. Martin Aherron, Diana Fitz, Gary Gross, Jesse Grunblatt, and Anthony Morse, Principal Investigators Feb. 1980 217 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS5-25081)

(E81-00088; NASA-CR-166650; CSU-1951-F) Avail: NTIS HC A10/MF A01 CSCL 08H

The application of LANDSAT data for monitoring drought impact is described. The use of optical and digital products was studied relative to operational requirements, reliability, image availability, and analytical procedures. A statewide (Colorado) field measurements program produced crop calendars for major crops, crop height-biomass relationships and criteria for image date selection. Cloud studies using NOAA-VHRR images generated cloud cover maps for Colorado, specifying the probability of having less than 10% or less than 50% cloud cover on any LANDSAT overpass during the growing season. The use of any color product is not recommended because of quality control problems and satellite system variations. An optical vegetation index product is recommended for statewide surveys of vegetation condition. A simple level slicing or graymapping procedure was effective for mapping and tabulating of biomass values over a three decade range, in 3 dB (2 to 1) steps or increments. A.R.H.

N81-21412*# Lancaster Univ. (England). Lunar and Planetary Unit.

SATELLITE MONITORING OF SEA SURFACE POLLUTION Final Report, Jan. 1977 - Oct. 1980

Gilbert Fielder, Timothy Stuart Hall, Principal Investigators, Duncan John Telfer, Lionel Wilson, and Richard John Fryer Oct. 1980 134 p Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send order to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(E81-10089; NASA-CR-164085; FR-2-16/F1) Avail: NTIS HC A07/MF A01 CSCL 08J

Thermal IR data from NASA's Heat Capacity Mapping Mission were used in a study of the feasibility of detecting oil spills in the seas around the UK. The period of observation covered the years 1978/9, in which there were no major spills in the area. A video processor capable of generating false color renderings of any satellite image from eight density levels was used in the synoptic search for spills. Other laboratory equipment, and associated analyses, were used to study the thermal behavior of

oil spills on water. Oil spills may appear to be warmer or cooler than the surrounding sea, depending on numerous factors. T.M.

N81-21413*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
INVESTIGATION OF GEOMAGNETIC FIELD FORECASTING AND FLUID DYNAMICS OF THE CORE Quarterly Status Technical Progress Report, 1 Jan. - 31 Mar. 1981
Edward R. Benton, Principal Investigator 1 Apr. 1981 6 p ERTS
(Contract NAS5-25957)
(E81-10093; NASA-CR-164091; QSTPR-5) Avail: NTIS HC A02/MF A01 CSCL 08G

The discovery of simple, theoretically sound upper limits for geomagnetic moments (dipole, quadrupole, etc.) provides a significant use of MAGSAT data, establishes useful constraints for future magnetic models, and bears strongly on the probable time required before the next polarity reversal can occur. The field models of MAGSAT data are of prime use and are highly suitable as supplied to date. A.R.H.

N81-21414*# Iowa Univ., Iowa City. Dept. of Geology.
USE OF MAGSAT ANOMALY DATA FOR CRUSTAL STRUCTURE AND MINERAL RESOURCES IN THE US MIDCONTINENT Quarterly Report, period ending 31 Mar. 1981
Robert S. Carmichael, Principal Investigator, Richard Hoppin, Ross Black, and Raymond Anderson 31 Mar. 1981 10 p ERTS
(Contract NAS5-26425)
(E81-10094; NASA-CR-164092; QR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

Magnetic fields were measured from October 1979 until June 1980 using the satellite. The processed magnetic data yield long wavelength anomalies that arise from crustal and upper mantle sources. Analysis techniques are being developed to help interpret the structure and character of the lithosphere in central North America. The region includes the Midcontinent Gravity Anomaly, peleorift zone and the New Madrid rift/seismic zone, both of which are of plaeotectonic and neotectonic interest. Preliminary analysis of the initial MAGSAT data combined with correlative geological and geophysical data shows the utility of the satellite data for regional crustal and basement study. E.D.K.

N81-21415*# Miami Univ., Fla. School of Marine and Atmospheric Science.
INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGSAT DATA Interim Report, Jan. - Mar. 1981
Christopher G. A. Harrison, Principal Investigator 31 Mar. 1981 15 p refs Sponsored by NASA ERTS
(E81-10095; NASA-CR-164093) Avail: NTIS HC A02/MF A01 CSCL 08C

The suitability of using magnetic field measurements obtained by MAGSAT is discussed with regard to resolving the medium wavelength anomaly problem. A procedure for removing the external field component from the measured field is outlined. Various methods of determining crustal magnetizations are examined in light of satellite orbital parameters resulting in the selection of the equivalent source technique for evaluating scalar measurements. A matrix inversion of the vector components is suggested as a method for arriving at a scalar potential representation of the field. Author

N81-21416*# Houston Univ., Tex. Dept. of Mathematics.
ON THE EXISTENCE, UNIQUENESS, AND ASYMPTOTIC NORMALITY OF A CONSISTENT SOLUTION OF THE LIKELIHOOD EQUATIONS FOR NONIDENTICALLY DISTRIBUTED OBSERVATIONS: APPLICATIONS TO MISSING DATA PROBLEMS
Charles Peters, Principal Investigator 10 Sep. 1980 21 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-14689; Proj. AgRISTARS)
(E81-10099; NASA-CR-160931; SR-HO-00492; Rept-76) Avail: NTIS HC A02/MF A01 CSCL 02C

A general theorem is given which establishes the existence and uniqueness of a consistent solution of the likelihood equations given a sequence of independent random vectors whose distributions are not identical but have the same parameter set. In addition, it is shown that the consistent solution is a MLE and that it is asymptotically normal and efficient. Two applications are discussed: one in which independent observations of a normal random vector have missing components, and the other in which the parameters in a mixture from an exponential family are estimated using independent homogeneous sample blocks of different sizes. Author

N81-21417*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FOREIGN COMMODITY PRODUCTION FORECASTING. PROGRAM REVIEW PRESENTATION TO LEVEL 1, INTER-AGENCY COORDINATION COMMITTEE Semiannual Project Management Report
6 Nov. 1980 137 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Proj. AgRISTARS)
(E81-10100; NASA-TM-82322; FC-J-04010; JSC-16835) Avail: NTIS HC A07/MF A01 CSCL 02C

Experiments planned to differentiate and inventory domestic and foreign wheat/barley and corn/soybean crops are described and methods for verifying the classifications and estimating the proportions are indicated. Tables and graphs show labeling accuracy, proportion estimation, and planting data model results for the various crops. A.R.H.

N81-21418*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PATCH IMAGE PROCESSOR USER'S MANUAL
M. J. Nieves, Principal Investigator Sep. 1980 12 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10101; NASA-CR-160930; EW-LO-00707; LEMSCO-15692; JSC-16833) Avail: NTIS HC A02/MF A01 CSCL 02C

The patch image processor extracts patches in various size (32 x 32, 64 x 64, 128 x 128, and 256 x 256 pixels) from full frame LANDSAT imagery data. With the patches that are extracted, a patch image mosaic is created in the image processing system, IMDACS, format. Author

N81-21419*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
IDENTIFICATION OF USSR INDICATOR REGIONS
J. Disler and H. Breigh, Principal Investigators Sep. 1980 81 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10102; NASA-CR-160935; FC-LO-04027; LEMSCO-15118; JSC-16847) Avail: NTIS HC A05/MF A01 CSCL 02C

Potential indicator regions were determined by comparing the statistics for barley and wheat at the lowest administrative levels for which published statistics were available. Fourteen were selected for review based on their relative abundances of wheat and barely. These potential indicator regions were grouped according to three conditions that could affect labeling and classification accuracies: (1) high-barley content; (2) presence of barley and spring wheat; and (3) presence of barley and winter wheat. Each region was further evaluated based on the availability of crop calendars, LANDSAT acquisitions, and ancillary data. Based on the relative abundance of wheat and barley and the availability of data, three indicator regions were recommended. Within each region, individual oblasts and/or krays were selected according to segment availability and segment acquisition histories for potential barley separation. A.R.H.

N81-21420*# Miami Univ., Fla. School of Marine and Atmospheric Science.
INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGSAT DATA Interim Report, Oct. - Dec. 1980
Christopher G. A. Harrison, Principal Investigator 31 Dec. 1980

2 p Sponsored by NASA ERTS
(E81-10104; NASA-CR-164098) Avail: NTIS HC A02/MF A01 CSCL 08J

The computer program package for dealing with MAGSAT data was refined and a program listing and deck of cards was forwarded for use by interested investigators. Instead of doing equivalent source calculations, it is proposed to use spherical harmonics to model the observed data since spherical harmonic functions are orthogonal and addition of higher degree and order harmonics can be done without recalculation of the harmonics of lower degree and order already calculated. These functions are much more easy to manipulate in that the height of the term of the observation can be taken care of with great facility. Downward calculation (after suitable filtering) can also be performed very simply. A.R.H.

N81-21421*# Texas Univ. at Dallas, Richardson. Center for Space Sciences.

INVESTIGATION OF THE EFFECTS OF EXTERNAL CURRENT SYSTEMS ON THE MAGSAT DATA UTILIZING GRID CELL MODELING TECHNIQUES Quarterly Status Technical Progress Report, 15 Sep. - 31 Dec. 1980

David M. Klumpar, Principal Investigator 5 Jan. 1980 7 p ERTS
(Contract NAS5-26309)
(E81-10105; NASA-CR-164099; QSTPR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

The feasibility of modeling magnetic fields due to certain electrical currents flowing in the Earth's ionosphere and magnetosphere was studied. Initial efforts were devoted to reading MAGSAT data tapes in preparation for further analysis of the MAGSAT data. Further efforts concern a modeling procedure developed to compute the magnetic field at satellite orbit due to hypothesized current distributions in the ionosphere and magnetosphere. This technique utilizes a linear current element representation of the large scale space current system. E.D.K.

N81-21422*# Texas A&M Univ., College Station. Remote Sensing Center.

DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report, Jul. - Oct. 1980

W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Oct. 1980 15 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24383)
(E81-10118; NASA-CR-164112; PR-3712-11) Avail: NTIS HC A02/MF A01 CSCL 02C

Ground truth, aircraft, and satellite data were examined in order to: (1) assess the capability for determining wheat and pasture canopy temperatures in a dryland farming region from HCMM data; (2) assess the capability for determining soil moisture from HCMM data in dryland crops (winter wheat) from adjacent range lands; and (3) determine the relationship of HCMM-derived soil moisture and canopy temperature values with the condition of winter wheat and dryland farming areas during the principal growth stages. The IR data were screened to include areas having greater than 60% pasture and surface temperatures were recalculated using the atmospheric correction factor calculated by the modified RADTRA model, and the July 29, 1978 IR data were analyzed. Screening the IR data improved the relationship for July 24/July 13 and October 7/August 31 temperature/API relationship. However the coefficient of determination was not improved in the July 29/July 13 relationship. A.R.H.

N81-21423*# Instituto Geografico Nacional, Madrid (Spain).

THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report

Rodolfo Nunez delasCuevas, D. Fernando Lopez deSagredo (Univ. Politecnica de Madrid), D. Joaquin Melia Miralles (Valencia Univ.), D. Pedro Herranz Araujo (Univ. Complutense), D. Jesus Paredes Perlado (Centro de Estudios Hidrograficos, Madrid), D. Gregorio Parrilla (Inst. Espanol de Oceanografia, Madrid), D. J. Luis Picon (Centro de Investigacion, Madrid), and D. J. Luis Labrandero, Principal Investigators (Consejo Superior de Investigaciones Cientificas, Madrid) 30 Jun. 1980 3 p Sponsored by NASA HCMM
(E81-10119; NASA-CR-164113; PR-3) Avail: NTIS HC A02/MF A01 CSCL 13B

Although no significant results were achieved during the report period, research continues. A sample of imagery showing thermal inertia and temperature differences over the northeastern United States and Europe was received. The project coordinator attended a TELLUS Project meeting in Ispra, Italy at which general guidelines for the future were established and the quality of the data received was discussed. A.R.H.

N81-21424*# Environmental Research Inst. of Michigan, Ann Arbor.

ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 16 May - 15 Aug. 1980

Robert Horvath, Principal Investigator, Richard Cicone, E. Crist, Richard J. Kauth, and W. Pont Sep. 1980 135 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E81-10122; NASA-CR-160890; ERIM-132400-48-P) Avail: NTIS HC A07/MF A01 CSCL 02C

Classification and technology development for area estimation of corn, soybeans, wheat, barley, and sunflowers are outlined. Supporting research for corn and soybean foreign commodity production forecasting is highlighted. Graphs profiling the greenness and brightness of the crops are presented. T.M.

N81-21425*# California Univ., Santa Barbara. Geography Remote Sensing Unit.

MULTISPECTRAL DETERMINATION OF SOIL MOISTURE Annual Report

John E. Estes, David S. Simonett, Principal Investigators, Earl J. Hajic, and Bruce J. Blanchard Dec. 1980 114 p refs Prepared in cooperation with Texas A & M Univ., College Station ERTS
(Contract NCC5-5)
(E81-10123; NASA-CR-164115) Avail: NTIS HC A06/MF A01 CSCL 08M

The edited Guymon soil moisture data collected on August 2, 5, 14, 17, 1978 were grouped into four field cover types for statistical analysis. These are the bare, milo with rows parallel to field of view, milo with rows perpendicular to field of view and alfalfa cover groups. There are 37, 22, 24 and 14 observations respectively in each group for each sensor channel and each soil moisture layer. A subset of these data called the 'five cover set' (VEG5) limited the scatterometer data to the 15 deg look angle and was used to determine discriminant functions and combined group regressions. T.M.

N81-21426*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SPATIAL AND TEMPORAL VARIATIONS IN LAGOON AND COASTAL PROCESSES OF THE SOUTHERN BRAZILIAN COAST

Nelson deJesusParada, Principal Investigator and Renato Herz Aug. 1980 24 p refs Presented at the 13th Symp. on Remote Sensing of Environ., Ann Arbor, Mich., Apr. 1979 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E81-10124; NASA-CR-164116; INPE-1848-RPE/205) Avail: NTIS HC A02/MF A01 CSCL 08C

From a collection of information gathered during a long period, through the orbital platforms SKYLAB and LANDSAT, it was possible to establish a method for the systematic study of the dynamical regime of lagoon and marine surface waters, on coastal plain of Rio Grande do Sul. The series of multispectral images analyzed by visual and automatic techniques put in evidence spatial and temporal variations reflected in the optical properties of waters, which carry different loads of materials in suspension. The identified patterns offer a synoptic picture of phenomena of great amplitude, from which trends of circulation can be inferred, correlating the atmospheric and hydrologic variables simultaneously to the overflight of orbital vehicles. T.M.

N81-21427*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

USE OF LANDSAT DATA FOR AUTOMATIC CLASSIFICATION AND AREA ESTIMATION OF SUGARCANE PLANTATION IN SAO PAULO STATE, BRAZIL

Nelson deJesusParada, Principal Investigator and Francisco Jose Mendonca Oct. 1980 23 p refs Submitted for publication Sponsored by NASA ERTS

(E81-10125; NASA-CR-164117; INPE-1929-RPE/254) Avail: NTIS HC A02/MF A01 CSCL 08B

Ten segments of the size 20 x 10 km were aerially photographed and used as training areas for automatic classifications. The study areas was covered by four LANDSAT paths: 235, 236, 237, and 238. The percentages of overall correct classification for these paths range from 79.56 percent for path 238 to 95.59 percent for path 237. T.M.

N81-21428*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

USING THE LANDSAT DATA COLLECTION SYSTEM FOR FIELD GEOPHYSICS: OPERATIONS IN THE BRITISH VIRGIN ISLANDS

William J. Webster, Jr., Walter K. Allen, Eugene L. Gilbert, and J. Earl Painter, Principal Investigators Dec. 1980 59 p refs ERTS

(E81-10126; NASA-TM-82018) Avail: NTIS HC A04/MF A01 CSCL 08G

This particular application was to vertical geodesy by tide gauge and tiltmeter on a small desert island in the British Virgin Islands. The performance of the LANDSAT system under potentially marginal circumstances was found to be excellent. T.M.

N81-21429*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

EVALUATION OF THREE TECHNIQUES FOR CLASSIFYING URBAN LAND COVER PATTERNS USING LANDSAT MSS DATA

Paul R. Baumann, Principal Investigator (State Univ. of New York at Oneonta) Jan. 1979 37 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10127; NASA-TM-82323; Rept-178) Avail: NTIS HC A03/MF A01 CSCL 08B

Three computer quantitative techniques for determining urban land cover patterns were evaluated. The techniques examined deal with the selection of training samples by an automated process, the overlaying of two scenes from different seasons of the year, and the use of individual pixels as training points. Evaluation was based on the number and type of land cover classes generated and the marks obtained from an accuracy test. New Orleans, Louisiana and its environs form the study area. The automated process produced results comparable, if not better than, sample classifications developed under normal manual approaches. Relative accuracy was at a level of 80 percent or higher except for urban classes outside the urban area. The overlay technique created good classifications with respect to the type of urban land cover classes, but had low relative accuracy in relation to the other techniques. Point clustering had very high accuracy for land cover classes and the residential class covering suburban areas separated well on the urban fringe. A.R.H.

N81-21430*# Business and Technological Systems, Inc., Seabrook, Md.

EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Oct. - 31 Dec. 1980

31 Dec. 1980 2 p ERTS

(Contract NAS5-26047)

(E81-10128; NASA-CR-164118; QR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

The software was considerably enhanced to accommodate a more comprehensive examination of data available for field modeling using the equivalent sources method by (1) implementing a dynamic core allocation capability into the software system for the automatic dimensioning of the normal matrix; (2) implementing a time dependent model for the dipoles; (3) incorporating the capability to input specialized data formats in a fashion similar to models in spherical harmonics; and (4) implementing the optional ability to simultaneously estimate observatory anomaly biases where annual means data is utilized. The time dependence capability was demonstrated by estimating a component model of 21 deg resolution using the 14 day MAGSAT data set of Goddard's MGST (12/80). The equivalent source model reproduced both the constant and the secular variation found in MGST (12/80). A.R.H.

N81-21431*# National Conference of State Legislatures, Denver, Colo.

SOIL EROSION AND SEDIMENT CONTROL LAWS. A REVIEW OF STATE LAWS AND THEIR NATURAL RESOURCE DATA REQUIREMENTS

Susan B. Klein Nov. 1980 110 p refs Sponsored by NASA (NASA-CR-164132) Avail: NTIS HC A06/MF A01 CSCL 05A

Twenty states, the District of Columbia, and the Virgin Islands enacted erosion and sediment control legislation during the past decade to provide for the implementation or the strengthening of statewide erosion and sediment control plans for rural and/or urban lands. That legislation and the state programs developed to implement these laws are quoted and reviewed. The natural resource data requirements of each program are also extracted. The legislation includes amendments to conservation district laws, water quality laws, and erosion and sediment control laws. Laws which provide for legislative review of administrative regulations and LANDSAT applications and/or information systems that were involved in implementing or gathering data for a specific soil erosion and sediment control program are summarized as well as principal concerns affecting erosion and sediment control laws. A.R.H.

N81-21432*# National Conference of State Legislatures, Denver, Colo. Natural Resource Information Systems Project.

NEW STATE FOREST PRACTICE LAWS. A REVIEW OF STATE LAWS AND THEIR NATURAL RESOURCE DATA REQUIREMENTS

Susan B. Klein Nov. 1980 85 p refs Sponsored in part by NASA

(NASA-CR-164140) Avail: NTIS HC A05/MF A01 CSCL 02F

Forest practice regulations can be established by being specified in state law or by being promulgated by some other official body delegated the authority to do so. At the state level, public regulation of private forest practices resulted, in many cases, in the enactment of state forest practice laws regulating both private, and in some cases, public landowner activities. These laws aim not only to protect natural environments, but also to encourage continuous productivity of forest lands, to maintain or enhance aesthetic values, and to serve as an implementing mechanism to control water pollution. Profiles of regulations in California, Idaho, Maine, Nevada, New Hampshire, Oregon, and Washington are examined and assessed. Voluntary guidelines in use in 18 states are summarized. A.R.H.

N81-21433*# National Conference of State Legislatures, Denver, Colo.

SELECT STATE INLAND WETLAND PROTECTION LAWS. A REVIEW OF THE STATE LAWS AND THEIR NATURAL RESOURCE DATA REQUIREMENTS

Susan B. Klein Nov. 1980 99 p refs Sponsored by NASA (NASA-CR-164144) Avail: NTIS HC A05/MF A01 CSCL 05D

Although many states afford some measure of protection for wetland areas through flood-plain regulations or through programs for coastal areas, shorelands, scenic and wild rivers or pollution control, few states have programs that adequately deal with conservation of wetlands. Only 16 states have legislation specifically regulating development or use of wetlands. Most of the wetland acts apply only to coastal wetlands, several to inland wetlands and three acts apply to both. Many other states are still regulating wetland use through the dredge and fill and/or critical area program. Several offer tax incentives to property owners to encourage protection of wetlands or broader open spaces. Many states have acquired wetlands for park and wildlife purposes and a large measure of wetland protection is achieved

by the very restrictive controls applied to floodways areas. Direct floodplain or floodway regulations or state standards for local regulations were adopted in 24 states but protection of ecological values of wetlands is rarely an explicit objective of these programs. Scenic and wild river programs adopted in one half of the states provide some protection for wetland areas. A.R.H.

N81-21434*# National Conference of State Legislatures, Denver, Colo.

A USER NEED STUDY AND SYSTEM PLAN FOR AN ARIZONA NATURAL RESOURCES INFORMATION SYSTEM REPORT TO THE ARIZONA STATE LEGISLATURE

Oct. 1980 307 p Sponsored by NASA

(NASA-CR-164131; Rept-80-1.2) Avail: NTIS HC A14/MF A01 CSCL 05B

A survey instrument was developed and implemented in order to evaluate the current needs for natural resource information in Arizona and to determine which state agencies have information systems capable of coordinating, accessing and analyzing the data. Data and format requirements were determined for the following categories: air quality, animals, cultural resources, geology, land use, soils, water, vegetation, ownership, and social and economic aspects. Hardware and software capabilities were assessed and a data processing plan was developed. Possible future applications with the next generation LANDSAT were also identified. A.R.H.

N81-21435# Food and Agriculture Organization of the United Nations, Rome (Italy).

REPORT ON THE SECOND FAO/UNFPA EXPERT CONSULTATION ON LAND RESOURCES FOR POPULATIONS OF THE FUTURE

1980 378 p refs Consultation held at Rome, 4-6 Dec. 1979 Sponsored in part by United Nations Fund for Population Activities

(ISBN-92-5-100925-2) Avail: NTIS HC A17/MF A01

A computer program was developed to determine the upper limits of the population-supporting capacities of lands and to compare derived estimates with data on present and projected populations in order to identify critical areas where land resources are insufficient to support existing and/or future populations and to indicate areas where action is required on the national and international level to rectify the situation. The land resources aspects are considered by delineating agro-ecological zones in which soil and climatic conditions, matched to crop productivity, are quantified. Land use/management aspects are treated by estimating the various potentials of the zones for the production of 19 crops under three levels of inputs with various conservation, calorie/protein, and crop mix alternatives. Present and projected population data is then related to the potential of the inventoried agro-ecological zones. The results obtained for the African continent are presented. A.R.H.

N81-21436*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INFERENCE OF THE BOUNDARY LAYER STRUCTURE OVER THE OCEANS FROM SATELLITE INFRARED MEASUREMENTS

C. Prabhakara, G. Dalu, R. Lo (Computer Sciences Corp., Silver Spring, Md.), and N. R. Nath (Computer Sciences Corp., Silver Spring, Md.) Sep. 1978 60 p refs

(NASA-TM-79653) Avail: NTIS HC A04/MF A01 CSCL 04A

The characteristics of the boundary layer of the atmosphere over the global oceans between about 50 deg N to 40 deg S were remotely sensed for three different periods, about 3 months each, during the year 1970. The spectral measurements made by Nimbus 4 Infrared Interferometer Spectrometer were used for this purpose. T.M.

N81-21437*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

AERIAL COLOR INFRARED PHOTOGRAPHY: APPLICATIONS IN CITRICULTURE

Carlos H. Blazquez and Frank W. Horn, Jr. Nov. 1980 89 p refs Prepared in cooperation with Florida Univ., Lake Alfred Original contains color illustrations

(NASA-RP-1067; TR-43-1) Avail: NTIS HC A05/MF A01 CSCL 02C

The photographic specifications and operational parameters in this handbook were determined in a large aerial color infrared (ACIR) photographic experiment and in a follow-up demonstration with the cooperation of Florida citrus growers and aerial photographers. The ACIR photography in the spring gave the best separation between healthy and diseased trees. The best scale for photointerpretation with the use of inexpensive analysis equipment was 1 in. = 333 ft. Photographs taken with a 12 in. focal length lens were far superior to those taken with a 6 in. focal length lens. A cell unit grid system, with window overlays for rapid photointerpretation and a black and white enlargement for ground verification, was developed for tree registration. Use of the enlargement in ground surveys reduced the survey time from 25 hours to 2.5 hours. The cell unit grid system is compatible with computer processing for rapid recording of photo interpreted data, storage, retrieval, and analysis. A mapping system with 99 percent accuracy was developed for fast surveillance of tree vigor and stress. A.R.H.

N81-21438*# Remote Sensing Inst., Brookings, S. Dak.

IRRIGATION MANAGEMENT WITH REMOTE SENSING Semiannual Status Report

Jim Heilman, Donald Moore, and Vic Myers 26 Nov. 1980 8 p ref

(Grant NAG5-37)

(NASA-CR-164143; SASR-1) Avail: NTIS HC A02/MF A01 CSCL 08H

A ground study was conducted utilizing hand held radiometers to collect visible, near infrared and thermal infrared measurements. The data were analyzed and evaluated in terms of the ground measurements, which included percent crop canopy cover. The results used to recommend future action regarding use of satellite data in irrigation management. R.C.T.

N81-21439*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.

UNDERSTANDING THE LANDSAT MARKET IN DEVELOPING COUNTRIES Final Report

Matthew R. Willard Nov. 1980 86 p refs

(Contract NASw-3204)

(NASA-CR-164171; Rept-30) Avail: NTIS HC A05/MF A01 CSCL 08F

The constraints on the growth of the market which stem from the development process itself and from a country's technical, political, and institutional attributes were examined. Four competing factors guide the development of policy regarding an operational land remote sensing system and are summarized. The factors are: there is a need to boost U.S. experts in areas where the U.S. holds a technological lead; the need to develop user applications in developing countries on their terms coincides with foreign policy; developing countries desire to take control of their own development; and the U.S. government wants to enlist the participation of major companies in the management, operation, and ownership of the operational system. T.M.

N81-21440*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

WESTERN REGIONAL REMOTE SENSING CONFERENCE PROCEEDINGS, 1979

1980 192 p Conf. held at Naval Postgraduate School, Monterey, Calif., 17 - 19 Oct. 1979

(NASA-CP-2148; Rept-A-8320) Avail: NTIS HC A09/MF A01 CSCL 05A

Remote sensing users from the 14 western states explained their diverse applications of LANDSAT data, discussed operational goals, and exchanged problems and solutions. In addition, conference participants stressed the need for increased cooperation among state and local governments, private industry, and universities to aid NASA's objective of transferring to user agencies the ability to operationally use remote sensing technology for resource and environmental quality management. A.R.H.

N81-21441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SPATIAL RESOLVING POWER OF EARTH RESOURCES SATELLITES: A REVIEW

John R. G. Townshend Sep. 1980 39 p refs Submitted for

publication
(NASA-TM-82020) Avail: NTIS HC A03/MF A01 CSCL 05B

The significance of spatial resolving power on the utility of current and future Earth resources satellites is critically discussed and the relative merits of different approaches in defining and estimating spatial resolution are outlined. It is shown that choice of a particular measure of spatial resolution depends strongly on the particular needs of the user. Several experiments have simulated the capabilities of future satellite systems by degradation of aircraft images. Surprisingly, many of these indicated that improvements in resolution may lead to a reduction in the classification accuracy of land cover types using computer assisted methods. However, where the frequency of boundary pixels is high, the converse relationship is found. Use of imagery dependent upon visual interpretation is likely to benefit more consistently from higher resolutions. Extraction of information from images will depend upon several other factors apart from spatial resolving power: these include characteristics of the terrain being sensed, the image processing methods that are applied as well as certain sensor characteristics. Author

N81-21442*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL MICROWAVE EMISSIONS FROM VEGETATED FIELDS: A COMPARISON BETWEEN THEORY AND EXPERIMENT
J. R. Wang, J. C. Shiue, S. L. Chuang (MIT, Cambridge), and M. Dombrowski Jul. 1980 27 p refs Submitted for publication
(NASA-TM-80739) Avail: NTIS HC A03/MF A01 CSCL 08F

The radiometric measurements over bare field and fields covered with grass, soybean, corn, and alfalfa were made with 1.4 GHz and 5 GHz microwave radiometers during August - October 1978. The measured results are compared with radiative transfer theory treating the vegetated fields as a two layer random medium. It is found that the presence of a vegetation cover generally gives a higher brightness temperature T(B) than that expected from a bare soil. The amount of this T(B) excess increases in the vegetation biomass and in the frequency of the observed radiation. The results of radiative transfer calculations generally match well with the experimental data, however, a detailed analysis also strongly suggests the need of incorporating soil surface roughness effect into the radiative transfer theory in order to better interpret the experimental data. Author

N81-21443*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT-2 AND LANDSAT-3 FLIGHT EVALUATION REPORT Flight Evaluation Report, 23 Jul. - 23 Oct. 1978
Thomas W. Winchester 1 Nov. 1978 251 p refs
(Contract NAS5-21808)
(NASA-CR-160045; Doc-78SDS4250) Avail: NTIS HC A12/MF A01 CSCL 05B

Flight performance analysis of LANDSAT 2 and LANDSAT 3 are presented for the period July 1978 to October 1978. Spacecraft operations and orbital parameters are summarized for each spacecraft. Data are provided on the performance and operation of the following subsystems onboard the spacecraft: power; attitude control; command/clock; telemetry; orbit adjust; magnetic moment compensating assembly; unified S band/premodulation processor; electrical interface; thermal narrowband tape recorders; wideband telemetry; attitude measurement sensor; wideband video tape recorders; return beam vidicon; multispectral scanner subsystem; and data collections. J.M.S.

N81-21444*# Texas A&M Univ., College Station. Remote Sensing Center.
SOIL MOISTURE DETERMINATION STUDY Final Report, 28 Jul. - 24 May 1979
Bruce J. Blanchard 1 Apr. 1979 76 p refs
(Contract NAS5-25144)
(NASA-CR-160046; FR-3829) Avail: NTIS HC A05/MF A01 CSCL 08M

Soil moisture data collected in conjunction with aircraft sensor and SEASAT SAR data taken near Guymon, Oklahoma are summarized. In order to minimize the effects of vegetation and roughness three bare and uniformly smooth fields were sampled 6 times at three day intervals on the flight days from August 2 through 17. Two fields remained unirrigated and dry. A similar pair of fields was irrigated at different times during the sample period. In addition, eighteen other fields were sampled on the nonflight days with no field being sampled more than 24 hours from a flight time. The aircraft sensors used included either black and white or color infrared photography, L and C band passive microwave radiometers, the 13.3, 4.75, 1.6 and .4 GHz scatterometers, the 11 channel modular microwave scanner, and the PRT5. A.R.H.

N81-21445*# Texas A&M Univ., College Station. Remote Sensing Center.
LANDSAT RANGE RESOURCE INFORMATION SYSTEM Final Report, Oct. 1979 - Jan. 1981
W. E. Boyd and J. Clifford Harlan 1981 25 p refs
(Contract NAS9-15468)
(NASA-CR-160920; RSC-3697-6) Avail: NTIS HC A02/MF A01 CSCL 05B

A series of test products were developed from LANDSAT data sets for North Central Texas that paralleled the needs of ranchers, technical personnel, and the media. The products and evaluation questionnaires were mailed to approximately 150 ranchers who had reported an interest in evaluating the information systems. In addition to the rancher group, fourteen media people and a thirty-three member group in the agri business/technical community was also chosen to receive test products. The group responses are analyzed. Examples of the test products and associated questionnaires are included. M.G.

N81-21446*# Texas A&M Univ., College Station. Remote Sensing Center.
CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Final Report
Bruce J. Blanchard, Marshall J. McFarland, Sidney Theis, and John G. Richter Feb. 1981 99 p refs
(Grant NsG-5193)
(NASA-CR-164142; Rept-3622-4) Avail: NTIS HC A05/MF A01 CSCL 08M

Electrical scanning microwave radiometer brightness temperature, meteorological data, climatological data, and winter wheat crop information were used to estimate that soil moisture content in the Great Plains region. Results over the predominant winter wheat areas indicate that the best potential to infer soil moisture occurs during fall and spring. These periods encompass the growth stages when soil moisture is most important to winter wheat yield. Other significant results are reported. R.C.T.

N81-21447*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
BASIC RESEARCH FOR THE EARTH DYNAMICS PROGRAM Semiannual Status Report, 1 Oct. 1980 - 31 Mar. 1981
Ivan I. Mueller Apr. 1981 64 p refs
(Contract NAS5-25888; Grant NsG-5265)
(NASA-CR-164159; SASR-6; SASR-3) Avail: NTIS HC A04/MF A01 CSCL 08E

A comparison of data from Project MERIT Short Campaign is presented. The time delay weight matrix in VLBI geodetic parameter estimation was investigated. The utilization of range difference observations in geodynamics is discussed. T.M.

N81-21448# Centre National d'Etudes Spatiales, Toulouse (France).
MATHEMATICAL AND PHYSICAL PRINCIPLES OF REMOTE SENSING
1978 851 p refs Partly in ENGLISH and FRENCH Proceedings of CNES Summer School of Space Phys. Lectures, Strasbourg, 18 Aug.-15 Sep. 1978
Avail: NTIS HC A99/MF A01

The physical and mathematical foundations of remote sensing are discussed. Subjects treated include the theoretical physics of remote sensing, thermal phenomena and energy exchange in the environment, and remote sensing problems stemming from the presence of the atmosphere. Also covered were image processing theory, data processing and instrumentation, and electromagnetic wave interaction with the environment. Special

study results concerning diffusion in the visible and the IR, ocean surface observation, and crop inventory algorithms are reported as examples of application. For individual titles, see N81-21449 through N81-21460.

N81-21449# Strasbourg Univ. (France).
FUNDAMENTAL PHYSICS OF TELEDETECTION [PHYSIQUE FONDAMENTALE DE LA TELEDETECTION]
F. Becker *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 1-107 refs In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

The physics needed to design and interpret remote sensor experiments are reviewed. Electromagnetic radiation is depicted as energy propagating in the form of transverse wave vectors. The waves interact with their media, particularly through energy transformations. The interactions can be oscillatory or corpuscular, depending on the wavelength and the type of interaction. Electromagnetic propagation in a vacuum and in a homogeneous medium are described. The parametric characteristics of the medium in relation to the type of radiation are shown. Radiation sources and measurement principles are defined. Characteristic photometric quantities for the ground-air interface are also given. The physics are applied in a brief overview of analysis methods for satellite remote sensor data. Author (ESA)

N81-21450# Geological Survey, Denver, Colo.
THERMAL PHENOMENA AND ENERGY EXCHANGE IN THE ENVIRONMENT
K. Watson *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 109-174 refs (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

An iterative model, initially chosen with only a few variables, is developed. The model comprehends heat transfer mechanisms, radiation laws and a differential heat conduction, or diffusion, equation. Also involved are the physics of the atmosphere, material properties, and the energy balance. The heat conduction equation and boundary condition necessary to thermal models, including linear and nonlinear transfer, are shown, then discussed for numerical solutions, error analysis, and model predictions. Field measurement problems are brought out, e.g., parameters and instruments, detectors and data collection, local versus regional effects, transients, etc. Image analysis techniques are also covered. Case histories of specific geologic applications are presented. General applications and the satellite systems approach are commented on, emphasizing model limitations and extensions.
Author (ESA)

N81-21451# Laboratoire de Meteorologie Dynamique, Paris (France).
TELEDETECTION OF EARTH RESOURCES: PROBLEMS ASSOCIATED WITH THE PRESENCE OF THE ATMOSPHERE [TELEDETECTION DES RESSOURCES TERRESTRES PROBLEMES LIES A LA PRESENCE DE L'ATMOSPHERE]
N. A. Scott *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 175-213 refs In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

Radiation propagating through an inhomogeneous medium (Earth atmosphere) is described theoretically. A radiative transfer equation and functions for transmission through a gas medium are developed. Specific infrared intensity is expressed in terms of: the spectral intensity of the absorption bands; the shape of the bands; Planck's function; the variation with altitude in the absorbing gas concentration; and in terms of necessary data for the parametric evaluation of the transfer equation, i.e., spectroscopic data. As an application to spectroscopic remote sensing, atmospheric parameters are determined by inversion of the transfer equation. Several calculation methods are suggested.
Author (ESA)

N81-21452# Kansas Univ., Lawrence.
THEORETICAL BASES AND METHODS OF IMAGE PROCESSING
R. Haralick *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 215-291 refs (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

Pattern discrimination and identification processes are summarized. The pattern discrimination process constructs a good decision rule f. The pattern identification process implements the decision rule on data sequence S sub d, thereby constructing a category identification sequence S sub c. Under the independence of units assumption, the decision rule f is a function from measurement space D to the category C and f determines a partition of D which induces a partition of S sub v. How decision rules are constructed is explained. Eight decision rules are examined for Bayes gain and maximum gain under specified prior probability functions. The effects of conditional independence assumptions, Markov dependence assumptions, and of the Markov tree dependence assumption are shown. Calculation of the goodness of approximations is demonstrated. Author (ESA)

N81-21453*# National Aeronautics and Space Administration, Washington, D. C.
THEORY ON DATA PROCESSING AND INSTRUMENTATION
Frederic C. Billingsley *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 293-447 refs (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01 CSCL 05B

A selection of NASA Earth observations programs are reviewed, emphasizing hardware capabilities. Sampling theory, noise and detection considerations, and image evaluation are discussed for remote sensor imagery. Vision and perception are considered, leading to numerical image processing. The use of multispectral scanners and of multispectral data processing systems, including digital image processing, is depicted. Multispectral sensing and analysis in application with land use and geographical data systems are also covered. Author (ESA)

N81-21454# Bern Univ. (Switzerland).
INTERACTION OF ELECTROMAGNETIC WAVES WITH THE ENVIRONMENT
E. Schanda *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 449-508 refs (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

A theoretical remote sensing system is outlined in block diagram. Measurement interference due to the presence of the atmosphere is discussed. Moreover, a relation between surface roughness and wavelength is shown, where roughness effects depend on the values of surface roughness and of heterogeneity compared to the wavelength used. Radiative transfer is modeled mathematically, including expressions for scattering and absorption. The use of line radiation data to calculate transition between energy levels is demonstrated. The cases of radiation in liquids and solids are covered. An application example of soil moisture mapping is shown. Theoretical results are placed in context for passive (microwave) radiometry and for various types of radar sensing. Author (ESA)

N81-21455# Ottawa Univ. (Ontario). Dept. of Electrical Engineering.
PROCESSING OF REMOTE SENSING DATA AND OPTIMIZATION
Morris Goldberg *In* CNES Math. and Phys. Principles of Remote Sensing 1978 p 509-642 refs (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

Computer processing of remotely sensed data is introduced. Multispectral scanner imagery from LANDSAT of an agricultural area in western Canada is used for illustrative purposes. Three types of information are distinguished: spectral, spatial and syntactic. Spectral information is what the sensor actually measures. Spatial information comes from the regularity property of the observed terrain. Syntactic information is information external to the image and provided by the user. Techniques based upon the spectral information are the simplest to implement and naturally the most widespread. Use of spatial information, in general, requires more computer time. Different ways of making use of the spatial information are discussed. The use of the syntactic information is the most complex due to the fact that it is difficult to quantify. The different steps involved in

computer analysis of remotely sensed data are defined. These includes input, preprocessing, segmentation, classification, and application (user interactive mode) of a world model. Hardware considerations are also briefly mentioned. Author (ESA)

N81-21456# Centre National d'Etudes Spatiales, Toulouse (France).
INFLUENCE OF THE ATMOSPHERE ON RADIATION REFLECTED OR EMITTED BY THE EARTH: DIFFUSION-ABSORPTION IN THE VISIBLE AND NEAR INFRARED [INFLUENCE DE L'ATMOSPHERE SUR LE RAYONNEMENT REFLECHI DU EMIS PAR LA TERRE: DIFFUSION-ABSORPTION DANS LE VISIBLE ET PROCHE INFRA-ROUGE]
M. Vieillefosse *In its* Math. and Phys. Principles of Remote Sensing 1978 p 643-670 refs In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

The atmosphere as a perturbation factor in remote sensing of the Earth surface is considered. Interference phenomena are discussed theoretically, emphasizing atmospheric diffusion. Expressions for the coefficient of extinction, the angular distribution of diffuse light, and Bouguer's law are given. Rayleigh diffusion and Mie diffusion are handled separately. A mathematical model combing these different phenomena is constructed. The model is then used to examine the atmospheric effect on image contrast, spectral distribution, and spatial distribution. A comparison with measured data from aerial photography is made. Results show the importance of minimizing the atmospheric effect by correctly choosing remote sensing parameters, i.e., view angle, time, etc. Author (ESA)

N81-21457# Centre National d'Etudes Spatiales, Toulouse (France).
OBSERVATION OF THE OCEAN: POSSIBILITIES FOR SENSING IN THE VISIBLE AND THE INFRARED [TRAVAUX PRATIQUES, NUMERO 1: OBSERVATION DE LA MER, POSSIBILITES OUVERTES EN VISIBLE ET INFRA-ROUGE]
M. Vieillefosse *In its* Math. and Phys. Principles of Remote Sensing 1978 p 671-714 refs In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

Remote sensing data taken from LANDSAT and aerial reconnaissance is examined in order to determine the orders of magnitude of the measured values, the signifiance of the observations, and the confidence limits of calculations. Using LANDSAT data, reflectance, atmospheric transmissivity, and the significance of physical measurements are determined. As an application, the organization of a flight for radiometric reconnaissance of the ocean surface is discussed. As a specific application, results from radiometric thermal infrared observation of an oil slick are reported. Calculation problems in data interpretation are brought out. Author (ESA)

N81-21458# Centre National d'Etudes Spatiales, Toulouse (France).
TELEDETECTION OF ENERGY TRANSFER BETWEEN THE GROUND AND THE ATMOSPHERE IN THE DOMAIN OF THE VISIBLE AND THERMAL INFRARED: HUMIDITY EFFECTS [TRAVAUX PRATIQUES, NUMERO 2: TELEDETECTION DES ECHANGES D'ENERGIE ENTRE SOL ET ATMOSPHERE DANS LE DOMAINE VISIBLE ET INFRA-ROUGE THERMIQUE. EFFETS DE L'HUMIDITE]
F. Becker *In its* Math. and Phys. Principles of Remote Sensing 1978 p 715-731 refs In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

The possibility of measuring energy and mass transfer between the ground and atmosphere, using aerial or satellite data, is studied. The signifiance of radiometric measurements made in the visible and thermal infrared is explained for a test case including ground truth data. The necessary conditions for the extraction of energy balance parameters from the analysis of spectral data are defined and the importance of hyperfrequencies is shown. The spectrum analysis scheme is described in detail and the numerous approximations used are commented on for uncertainty effects. Author (ESA)

N81-21459# Centre National d'Etudes Spatiales, Toulouse (France).
RELATIONS BETWEEN RADIATION AND THE STRUCTURE OF A SCENE [TRAVAUX PRATIQUES, NUMERO 3: RELATIONS ENTRE RAYONNEMENT ET STRUCTURE]
G. Saint *In its* Math. and Phys. Principles of Remote Sensing 1978 p 735-790 In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

The structure of a scene is defined by its geometrical properties and by its radiometric properties. The influence of scene contour on luminance is determined analytically. Secondary reflection is taken into consideration. Calculation results are extended to a statistical surface description. Weighting functions are derived, accounting for atmospheric emission and transmission at varying altitudes. Both aerial and ground measurements are used based on vertical temperature sounding. Expressions are formalized as a model of vegetative ground cover. A generalized equation for radiative transfer is developed and an approximation solution is presented. Extensive numerical analysis of model parameters under different radiation conditions is shown, characterizing ground cover. Author (ESA)

N81-21460# Centre National d'Etudes Spatiales, Toulouse (France).
CROP INVENTORIES IN BEAUCE, BASED ON MULTISPECTRAL AND MULTITEMPORAL ANALYSIS OF LANDSAT DATA [TRAVAUX PRATIQUES, NUMERO 4: INVENTAIRE DE CULTURES EN BEAUCE PAR ANALYSE MULTISPECTRALE ET MULTITEMPORELLE DES DONNEES LANDSAT]
Traizet *In its* Math. and Phys. Principles of Remote Sensing 1978 p 791-833 In FRENCH (For primary document see N81-21448 12-43)
Avail: NTIS HC A99/MF A01

Several methods for establishing an inventory of ground cover were applied to LANDSAT data from 1976. The relative roles of the mathematics applied and of interpretation as well as the significance of the physical parameters of the objects under observation are brought out. The data compilation scheme is described. Three analysis techniques are reviewed: (1) direct analysis of histograms; (2) statistical analysis by Gaussian approximation; and (3) nonsupervised digital techniques. Results show that both the direct analysis and statistical analysis provide satisfactory image classification, with the Gaussian scheme presenting certain advantages for extending the observations. Nonsupervised techniques, while providing good feature separation for some special cases, e.g. wilderness, are as yet poorly adapted to crop inventory applications. Author (ESA)

N81-21461# Andrulis Research Corp., Bethesda, Md.
AUTOMATIC CARTOGRAPHIC FEATURE IDENTIFICATION Final Technical Report, Aug. 1979 - Sep. 1980
Thomas J. Lawson Jan. 1981 53 p
(Contract F30602-79-F-0215; AF Proj. 3203)
(AD-A095986; RADC-TR-80-387) Avail: NTIS HC A04/MF A01 CSCL 08/2

The objective of the study efforts presented in this report was to identify and test automatic identification techniques whereby descriptor data is entered into the digital record for selected features and additional descriptor data for given sets of features is derived by computational techniques. This study was divided into three phases. In the first phase, general background and knowledge of the problems was gained, and potential solutions were identified. This was accomplished by site visits to DMA facilities, literature review, and discussions with experts in cartography and related areas. Section 2 of the report discusses this phase in greater detail. The second phase was concerned with experimental testing of techniques identified as having the greatest potential payoff. Section 3 of the report details the experiments conducted, their significance and recommended further testing in these areas. Section 4 contains more detail on suggested further research based upon the experimental results. The third and final phase was concerned with the development of a conceptual integrated system for the digital processing of cartographic data. Section 5 presents Andrulis: general concepts for the design of such a system.GRA

N81-21462# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADC MULTI-DIMENSIONAL SIGNAL-PROCESSING RESEARCH PROGRAM Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1980
Dan E. Dudgeon 30 Sep. 1980 19 p refs
(Contract F19628-80-C-0002; AF Proj. 4594)
(AD-A096391; ESD-TR-80-218) Avail: NTIS HC A02/MF A01 CSCL 05/8

This Semiannual Technical Summary Report covers the significant results of the Multi-Dimensional Signal-Processing Program in the areas of image modeling, image segmentation and classification, advanced digital filter implementations for image processing, and iterative algorithms for image restoration and enhancement. GRA

N81-21463# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
UPDATED PLAN FOR SUPPORT OF RESEARCH RELATED TO GEOTHERMAL RESERVOIR ENGINEERING
J. H. Howard, N. E. Goldstein, and A. N. Graf Sep. 1980 59 p refs
(Contract W-7405-eng-48)
(LBL-10807) Avail: NTIS HC A04/MF A01

The original plan for support of research in geothermal reservoir engineering, GREMP, was reviewed and compared with accomplishments to date. A commentary on the comparison and an updated plan are presented. Also included are a justification of the updated plan and a reviewed management plan. DOE

N81-21464# Department of Energy, Washington, D. C. Office of Coal Supply Development.
WESTERN COAL SURVEY: A SURVEY OF COAL MINING CAPACITY IN THE WEST
Jan. 1981 60 p
(DOE/RA-0045/1) Avail: NTIS HC A04/MF A01

The purpose of the survey is to track progress and changes in productive capacity. Specifically, the survey seeks estimates of current and future productive capacity, of amounts of coal currently under contract, and of potential constraints to higher production. The report identifies 116 western mines producing 200,000 tons or more in 1980, 209 such mines in 1985 and 221 in 1990. All but 29 of the future operations are expected to be producing by the end of 1985. Of these 29, 12 begin production in 1986 and 9 in 1987. Six existing mines are expected to be mined out or abandoned by 1990. DOE

N81-21465# Los Alamos Scientific Lab., N. Mex.
REMOTE CHARACTERIZATION OF FLUID SATURATION IN WESTERN SANDS Progress Report, 1 Apr. 1979 - 31 Mar. 1980
Ernest B. Nuckols and Jasper A. Jackson Dec. 1980 58 p refs
(Contract W-7405-eng-36)
(LA-8314-PR) Avail: NTIS HC A04/MF A01

The development of methods to define fluid saturation porosity, and permeability in western gas sands as found under in situ reservoir conditions is considered. These analyses are being coordinated with nuclear magnetic resonance (NMR) studies, which will lead ultimately to the design of an improved downhole NMR tool. DOE

N81-21466# California Univ., Livermore. Lawrence Livermore Lab.
EQUATORIAL HYDROLOGY STUDIES BY SATELLITE TELEMETRY
Bruce Clegg, John Koranda, William Robison, and Gale Holladay 30 Dec. 1980 22 p refs
(Contract W-7405-eng-48)
(UCID-18869) Avail: NTIS HC A02/MF A01

The use of a geostationary satellite as a transponder to collect surface environmental data to describe the fate of soil-borne radionuclides is discussed. The remote, former atomic testing grounds at the Enewetak and Bikini Atolls present a difficult environment in which to collect continuous field data. Land-based, solar powered microprocessor, and environmental data systems remotely measure net and total solar radiation, rain, humidity, temperature, and soil-water potentials. A water-flux model predicted wet season plant-transpiration rates nearly equal to the 6 to 7 mm/d evaporation-pan rate, which decreases to 2 to 3 mm/d for the dry season. From the microclimate data a 1:3 and 1:20 (137) Cs dry-matter concentration ratio was estimated, which was later confirmed by radioisotopic analysis. This ratio exacerbates the dose to man from intake of food plants. Nephelometer measurements of airborne particulates indicate a minimum respiratory radiological dose. M.G.

N81-21467# Oak Ridge National Lab., Tenn. Chemical Technology Div.
FUTURE US ENERGY SUPPLY: CONSTRAINTS BY NONFUEL MINERAL RESOURCES
H. E. Goeller Dec. 1980 114 p refs
(Contract W-7405-eng-26)
(ORNL-5656) Avail: NTIS HC A06/MF A01

Current energy-related requirements for the various elements and mineral products are established. Domestic and world reserves and resources for each nonrenewable resource are assessed and a ranking made of impending domestic scarcities by using resource-to-demand ratios. Special problems on by-products production are noted, followed by a discussion on import dependency. The roles of recycle and substitution are assessed, and the possibilities for synthesis of nonelement commodities are reviewed. Detailed requirements for the more widely used materials in a large number of energy supply systems are provided, followed by newer future requirements for more advanced energy systems anticipated to be in widespread use in the next century. Finally, the various problems associated with 16 elements deemed most likely to become scarce within the next 50 years are resummarized, and general conclusions are provided. DOE

N81-21468# Sandia Labs., Albuquerque, N. Mex. SPR Geotechnical Div.
STRATEGIC PETROLEUM RESERVE (SPR) GEOLOGICAL SUMMARY. WEEKS ISLAND SALT DOME
Terri Smith Ortiz Oct. 1980 54 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1323) Avail: NTIS HC A04/MF A01

A portion of the Weeks Island Salt Dome in southern Louisiana was purchased for use as a crude oil storage facility, mine. Geotechnical investigations of the conventional underground salt mine are summarized. Topics cover site geology, material properties of the salt, the condition of the oil storage area, the status of other activities in the salt dome, and recommendations. DOE

N81-21469# Marconi Co. Ltd., Chelmsford (England).
ADDITIONAL STUDIES OF EARTH RESOURCES.SYNTHETIC APERTURE RADAR PAYLOAD. VOLUME 1: EXECUTIVE SUMMARY Final Report
S. R. Brooks and W. Rupp Paris ESA Jun. 1980 37 p
Prepared in cooperation with Messerschmitt-Boelkow-Blohm G.m.b.H., Munich
(MTR-80/24-Vol-1; ESA-CR(P)-1389-Vol-1) Avail: NTIS HC A03/MF A01

The synthetic aperture radar (SAR) payload for a European remote sensing satellite is discussed. Improvements in gray level resolution, onboard calibration, image quality definitions, and antenna design features are examined. Author (ESA)

N81-21470# European Space Agency, Paris (France).
CONTRIBUTION TOWARDS AUTOMATIC INVESTIGATION AND PERCEPTION OF TEXTURE IN DIGITIZED REMOTELY SENSED IMAGES Ph.D. Thesis - Tech. Univ., Berlin
Rudolf Fiedler Nov. 1980 242 p refs Transl. into ENGLISH of 'Beitrag zur Automatischen Untersuchung u. Erkennung von Texturen in Digitalisierten Bildern aus der Fernerkundung' DFVLR, Oberpfaffenhofen, West Germany Report DFVLR-FB-79-08, Feb. 1979 Original report in GERMAN previously announced as N80-22670
(ESA-TT-621; DFVLR-FB-79-08) Avail: NTIS HC A11/MF A01

The problems that arise from the automated analysis of texture in images are reviewed. Mathematical algorithms are presented for the determination of texture and borders as well as texture classification. The description makes use of the frequency dependence of the image structure that characterizes texture.

The interactive digital image processing system, DIBIAS, which provided the images for the analysis is described. Author (ESA)

N81-21471# Idaho Univ., Moscow. Water Resources Research Inst.

A FIVE-YEAR PLAN FOR WATER RESOURCES RESEARCH AND ASSOCIATED TECHNOLOGY TRANSFER NEEDS

C. C. Warnick and Warren Reynolds Oct. 1980 25 p refs
(PB81-124489; W81-00330) Avail: NTIS HC A02/MF A01 CSCL 13B

Idaho identified five categories of research priorities: energy, irrigated agriculture, environmental, institutional and social, and water conservation. Technology transfer will be a major concern in all five of the priority areas. GRA

N81-21472# Geological Survey, Rolla, Mo. Water Resources Div.

PHYSICAL ENVIRONMENT AND HYDROLOGIC CHARACTERISTICS OF COAL-MINING AREAS IN MISSOURI Final Report

Jerry E. Vaill and James H. Barks Aug. 1980 39 p refs
(PB81-126765; USGS/WRD/WRI-80/076; USGS/WRI-80/67) Avail: NTIS HC A03/MF A01 CSCL 08H

Hydrologic information for the north-central and western coal-mining regions of Missouri is needed to define the hydrologic system in these areas of major historic and planned coal development. This report describes the physical setting, climate, coal-mining practices, general hydrologic system, and the current (1980) hydrologic data base in these two coal-mining regions. Streamflow in both mining regions is poorly sustained. Stream water quality generally varies with location and the magnitude of coal-mining activity in a watershed. GRA

N81-21473# Geological Survey, Harrisburg, Pa. Water Resources Div.

DEVELOPMENT OF A DIGITAL MODEL OF GROUND-WATER FLOW IN DEEPLY WEATHERED CRYSTALLINE ROCK, CHESTER COUNTY, PENNSYLVANIA Final Water-Resources Investigations

Laurence J. McGreevy and Ronald A. Sloto Mar. 1980 48 p refs
(PB81-132896; USGS/WRD/WRI-80/083; USGS/WR1-80/2) Avail: NTIS HC A03/MF A01 CSCL 08H

The model simulates recharge to, flow through, and discharge from the water table aquifer in a 5.98 square mile basin representative of most of Chester County, Pennsylvania. The two dimensional finite-difference model of Trescott, Pinder, and Larson was used. The way ground water evapotranspiration varies with depth was modified, and a minimum transmissivity, was added to prevent the model from 'going dry'. Test of the model showed good correlation with field data, but also showed that additional information would make the model more reliable. GRA

N81-21474# Geological Survey, Huron, S. Dak.

TECHNICQUES FOR ESTIMATING FLOOD PEAKS, VOLUMES, AND HYDROGRAPHS ON SMALL STREAMS IN SOUTH DAKOTA Final Report

Lawrence D. Becker Sep. 1980 89 p refs Sponsored in part by South Dakota Dept. of Transportation
(PB81-136145; USGS/WRI-80/80; FHWA-SD-80-80) Avail: NTIS HC A05/MF A01 CSCL 08H

For 115 gaged sites, the estimates are from frequency curves defined from the gaging records. Estimates were made for ungaged sites using regression relations based on drainage basin size, main channel slope, and soil-infiltration index. Estimating relations are applicable for flood peaks on watersheds draining 0.05 to 100 square miles and for flood volumes on watersheds draining from 0.05 to 15 square miles. A method is indicated for using the estimating procedures and embankment ponding to design smaller highway culverts. GRA

N81-21475# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.

INFILTRATION DRAINAGE OF HIGHWAY SURFACE WATER Final Report

Kenneth A. Jackura Jul. 1980 106 p refs
(Contract DPT-E-3-4)
(PB81-135998; TL-632131; FHWA/CA/TL-80/04) Avail: NTIS HC A06/MF A01 CSCL 08H

Disposal of highway storm water runoff is a growing problem within densely populated areas of California. The flat terrain and limited natural water channels in some regions requires surface runoff to be stored rather than dumped into already overburdened storm water systems or drainage channels. Increased utilization of drainage basins and drainage wells for disposing of storm water runoff are discussed. Emphasis is placed on incorporating infiltration into the design criteria of drainage basins constructed in previous soils. GRA

N81-21476# Purdue Univ., Lafayette, Ind. Water Resources Research Center.

OPTIMAL PARAMETER ESTIMATION AND INVESTIGATION OF OBJECTIVE FUNCTIONS OF URBAN RUNOFF MODELS

Ji Han and A. Ramachandra Rao Sep. 1980 172 p refs
(Contract DI-14-34-0001-8016)
(PB81-131096; PWRRC-TR-135; W81-00553; OWRT-A-056-IND(1)) Avail: NTIS HC A08/MF A01 CSCL 08H

Three urban runoff models, ILLUDAS, SWMM and MINNOUR were studied and results showed that the optimal parameter estimates gave better regeneration and prediction performances than cases where the parameters were arbitrarily specified. Another result was that the complexity of the model structure did not guarantee better performance. GRA

N81-21477# North Dakota Water Resources Research Inst., Fargo.

WATER RESOURCES RESEARCH FIVE-YEAR PLAN/ 1982-1987 (NORTH DAKOTA)

Lewis Lubka 1980 87 p refs
(PB81-124497; W81-00331) Avail: NTIS HC A05/MF A01 CSCL 13B

The water resources background of North Dakota, including geology, hydrology, meteorology, water data availability, and problem awareness identified trends in water consumption, water-related problems, and the significant recent studies concerning water and land resources were examined. Problem areas identified were: inadequate surface water supply; overdraft of groundwater; pollution of surface water; pollution of groundwater; drinking water quality; flooding; erosion and sedimentation; and wetlands. GRA

N81-21478# National Geodetic Survey, Rockville, Md.

HORIZONTAL CONTROL

Joseph F. Dracup Jun. 1980 46 p refs
(PB81-133050; NOAA-TR-NOS-88; NGS-19; NOAA-80102101) Avail: NTIS HC A03/MF A01 CSCL 08E

The horizontal geodetic control network of the United States consists of about 240,000 stations of first-, second-, and third-order accuracies. Today, surveys can be made to accuracies that were impractical only a few decades ago. This improvement is attributed to advances in electronics and the utilization of satellites and quasars. The publication and maintenance of up-to-date data are a task which has been made manageable by automation. When the new adjustment of the North American Datum is completed in the mideighties the adjusted data will represent the optimum results obtainable. GRA

N81-21479# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.

THE FREE OSCILLATIONS OF LAKE ST. CLAIR: AN APPLICATION OF LANCZOS' PROCEDURE

David J. Schwab Jul. 1980 17 p refs
(PB81-134520; NOAA-TM-ERL-GLERL-32; GLERL-CONTRIB-237) Avail: NTIS HC A02/MF A01 CSCL 08H

The frequencies and structures of the five lowest free oscillations of Lake St. Clair are determined by a Lanczos procedure. With the Lanczos procedure, a high resolution numerical grid can be used to resolve the detailed structures of the modes. The lowest mode has a calculated period of 4.08 h. GRA

N81-21480# Nevada Univ. System, Reno. Water Resources Center.

ENVIRONMENTAL CONTROLS ON OCCURRENCE AND CHEMISTRY OF GROUNDWATER IN A CARBONATE TERRANE OF EASTERN NEVADA

Carl A. Johnson (Fuero, Inc., Long Beach, Calif.) Jul. 1980 111 p refs

(Contract DI-14-31-0001-3303)

(PB81-131112; PUB-41066; W81-00637; OWRT-B-045-NEV(1)) Avail: NTIS HC A06/MF A01 CSCL 08H

The definition of carbonate aquifer characteristics in arid regions is important to a better understanding of water supply sources in Nevada. Primary controls are geological structure, mineralogy and physical properties of rocks and climate. Springs demonstrate a seasonal cyclic variation in discharge but relatively constant chemistry drain a large scale area wide flow system. Amount of snowfall, seasonal temperature, and mineralogy of rocks are most influential on solution activity of groundwater, and ultimate chemical quality and discharge of spring waters. GRA

N81-21481# Ohio State Univ., Columbus. Water Resources Center.

DEVELOPMENT OF A MATHEMATICAL MODEL FOR URBAN RUNOFF QUANTITY AND QUALITY

S. Sarikelle Mar. 1980 149 p refs Prepared in cooperation with Akron Univ., Ohio

(PB81-134561; RF-760851-710797; W80-06562; OWRT-A-055-OH10(1)) Avail: NTIS HC A07/MF A01 CSCL 08H

The development and efficiency of a quantity and quality mathematical model for urban runoff with simple input to be used in conjunction with studies related to urban waste water management is outlined. The model, called a Modified Linearized Subhydrographs Urban Runoff Model (MLSURM), is capable of simulating runoff for either separate or combined sewer systems. The quantity model basically represents the simulation of runoff flow for a given rainfall event based on simple hydrographs of each subcatchment area and the storm duration. The model is useful, however, for analysis of existing sewer systems, design of new sewer systems, land use planning, and effective land management. GRA

N81-21482# West Virginia Univ., Morgantown. Water Research Inst.

PREDICTING NORMAL MINIMUM-FLOW RATES FOR UNGAGED STREAMS IN WEST VIRGINIA Final Report

Richard Lee, Henry W. Rauch, Douglas G. Boyer, and Ellen Snyder Nov. 1980 75 p refs

(Contract DI-14-34-0001-9052)

(PB81-138000; W81-00685; OWRT-A-038-WVA(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

Comprehensive analyses of a wide range of watershed characteristics were conducted in order to develop deterministic relationships and statistical models for predicting normal minimum flow rates in ungaged West Virginia streams. Statistical models incorporating basin area, normal annual discharge, and a seasonal recession constant were effective in estimating Q7-10 with an accuracy as great as the consistency of the variable itself. Of the geologic variables tested, area of carbonate rock was most highly correlated with low-flow parameters. GRA

N81-21483# Michigan State Univ., East Lansing. Inst. of Water Research.

NITROGEN LOADING: INFLUENCE ON DISSOLVED INORGANIC CARBON IN NATURAL WATERS

John T. Lehman Nov. 1980 29 p refs

(Contract DI-14-34-0001-0124)

(PB81-142226; W81-00688; OWRT-A-109-MICH(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

One of the links between physiological activities of phytoplankton and the dissolved inorganic carbon in natural waters is more subtle than the CO2 producing and CO2 consuming processes of respiration, and photosynthesis. When phytoplankton absorb nutrients, particularly inorganic nitrogen, they alter the alkalinity of the water thereby directly affecting the capacity of the system to retain inorganic carbon in solution. This can lead to large differences in both standing stocks and maximal sustained rates of primary production depending on the chemical form of N that is supplied. The experimental work is supplemented with analyses of lakes that have experienced severe changes in nitrogen loading. GRA

N81-21484# Geological Survey, Doraville, Ga. Water Resources Div.

IMPACT OF URBAN STORM RUNOFF ON STREAM QUALITY NEAR ATLANTA, GEORGIA Final Report, Oct. 1975 - Oct. 1977

James B. McConnell Aug. 1980 66 p refs

(Contract EPA-IAG-D6-0137)

(PB81-142473; EPA-600/2-80-094) Avail: NTIS HC A04/MF A01 CSCL 08H

The impact of stormwater runoff from point and nonpoint sources on the water quality of receiving streams in the Atlanta area was assessed. Emphasis was placed on the collection of water-quality data in the summer and autumn to determine the impact on streams from runoff produced by thunderstorms during the dry-weather seasons. Compared to dry-weather flow, stormwater runoff significantly increased the average concentration of suspended sediment, BOD5, total organic carbon, total ammonia nitrogen, total phosphorus, fecal coliform bacteria, and trace metals in most receiving streams in the Atlanta Metropolitan Area. Stormwater runoff increased the mean concentration of most constituents 2 to 5 fold. GRA

N81-21485# Purdue Univ., Lafayette, Ind. Water Resources Research Center.

GREEN RIVER BASIN OPTIMIZATION-SIMULATION MODEL

Hasan Yazicigil, Gerrit H. Toebes, and Mark H. Houck Nov. 1980 206 p refs

(Contract DI-14-34-0001-8084)

(PB81-143356; TR-137; W81-00806; OWRT-B-094-IND(5)) Avail: NTIS HC A10/MF A01 CSCL 08H

An optimal operation of an existing multi-purpose multireservoir system using forecasts is described. An optimization - simulation model is constructed for a system of four flood control reservoirs in the Green River Basin, Kentucky, having recreation and low-flow augmentation as secondary objectives. The resulting model, called GRBOPM, is designed for use in real time as well as in long run operation studies. The descriptive components of the model consists of a segmented model comparising nine multi input linear models of the river system downstream of the four reservoirs. The use of the GRBOPM2 model in long-run reservoir operations studies is demonstrated. GRA

N81-21486# Tennessee Univ., Knoxville. Water Resources Research Center.

DEVELOPMENT OF MODELS TO PREDICT QUALITY OF RUNOFF WATER FROM AGRICULTURAL WATERSHEDS

Curtis H. Shelton and Gary M. Lessman Sep. 1980 39 p refs

(Grant DI-14-34-0001-7089)

(PB81-143380; W81-00805; OWRT-A-047-TENN(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

Municipal sewage sludge following primary sedimentation was applied on a 3.7 ha watershed during four winter months of 1976, 1977, and 1978 at rates of 20.8, 25.7, and 25.2 t/ha (dry weight), respectively. Samples of the sludge surface runoff, groundwater, soil, and corn leaves were analyzed for selected nutrients and metals. Infrequent high concentrations of nutrients and metals, as well as fecal coliform count, were attributed to runoff occurring soon after applications of sludge when little or no vegetation was present. Data used for generation and testing of regression equations to predict sediment yield were obtained from a total of 145 runoff events on four small agricultural watersheds during the period 1974-1979. GRA

N81-21487# Missouri Univ. -Columbia.

STREAM-WATERSHED RELATIONSHIPS IN THE MISSOURI OZARK PLATEAU PROVINCE Ph.D. Thesis

Miles M. Smart Aug. 1980 198 p refs

(Contract DI-14-34-0001-9027)

(PB81-143398; W81-00803; OWRT-A-111-MO(1)) Avail: NTIS HC A09/MF A01 CSCL 08H

Land use is the most influential watershed characteristic determining chemical concentrations of 23 streams that drained watersheds with different land uses, geologic bedrock and soil

associations in the Missouri Ozark Plateau Province. Streams draining watersheds with urban land use had the highest chemical concentrations and streams draining pasture watersheds were intermediate, more closely resembling streams in overall salinity and urban streams in nitrogen and phosphorous. Prediction of stream chemical concentrations and algal biomass from watershed land use are used to assess changes in streams that occur as the result of changes on the watershed. GRA

N81-21488# Geological Survey, Helena, Mont. Water Resources Div.

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1979 Annual Water Data Report, 1 Oct. 1978 - 30 Sep. 1979

Jul. 1980 857 p refs
(PB81-144073; USGS-WRD-HD-80-070) Avail: NTIS HC A99/MF A01 CSCL 08H

The data consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. Discharge records for 226 gaging stations; stage only records for 1 lake station; stage/contents for 9 lakes and reservoirs; water quality for 137 stations, 3 lakes and water levels for 23 observation wells are included. Also included are 172 crest stage partial record stations and 43 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data collection programs, and are published as miscellaneous measurements. GRA

N81-21689*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AURORAL X-RAY DETECTION FROM ROCKET OVERFLIGHTS

A. Goldberg, J. R. Barcus, L. H. Gesell (Computer Sciences Corp., Silver Spring, Md.), and R. R. Vondrak (SRI International, Menlo Park, Calif.) *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 Mar. 1981 p 268 Presented at the Intern. Union of Geodesy and Geophys. (IUGG) Proc., Middle Atmosphere Symp., Canberra, Australia, Dec. 1979 (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 03B

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-21489 International Institute for Applied Systems Analysis, Laxenburg (Austria).

SOLAR OPTIONS IN CENTRAL EUROPE. A SYNTHESIS OF SOLAR TECHNOLOGY ASSESSMENT AND CONTEMPORARY CRITERIA IN 1978-1979

Charles R. Bell Dec. 1979 32 p refs Transl. into ENGLISH of Revue de l'Energie (Paris), Mar. 1979
(IIASA-RR-79-14) Avail: Issuing Activity

Solar energy as a potential substitute for fossil fuels is evaluated, and the time phase in which solar technology can become a significant part of the energy supply mix is discussed. Constraints, such as the characteristic uncertainties of solar energy inputs, the developmental status of solar technology, and the evolution of other energy supply alternatives, are also described. The options that are at present most viable for solar energy exploitation in central Europe as well as the economic and technical parameters of these options are identified. A correlation with prototype data is made whenever possible to maximize the usefulness of the results. Author (ESA)

N81-21490# International Institute for Applied Systems Analysis, Laxenburg (Austria).

EFFECTS OF ACCOUNTING RULES ON UTILITY CHOICES OF ENERGY TECHNOLOGIES IN THE UNITED STATES

Bernard I. Spinrad Jul. 1980 35 p refs
(IIASA-RR-80-27) Avail: Issuing Activity

Comparisons of the costs of power systems, specifically the cost of nuclear versus other power systems, are discussed. The effects of inconsistent accounting are examined. Five systems that supply electrical power are cost analyzed: (1) light water reactors; (2) liquid metal fast breeder reactors; (3) coal plants, with scrubbers, burning low sulfur or processed high sulfur coal; (4) coal plants with fluidized bed combustion of high sulfur coal; and (5) solar power plants with sufficient storage for baseload use. Cost estimates for the system are made and justified. Cost comparison results show that, contrary to currently accepted conclusions, light water reactors have a decisive cost advantage over coal; if assumed target costs are met, after development, liquid metal fast breeder reactor would be the cheapest system; and if postdevelopment target costs are met, solar power plants are almost competitive with the nuclear systems and are much cheaper than coal. Author (ESA)

N81-21491*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.

SATELLITE POWER SYSTEM (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). VOLUME 2: SYSTEMS/SUBSYSTEMS ANALYSES Final Report

G. M. Hanley Washington NASA Mar. 1981 338 p refs
(Contract NAS8-32475)
(NASA-CR-3393; SSD-80-0108-2) Avail: NTIS HC A15/MF A01 CSCL 10A

Modifications to the reference concept were studied and the best approaches defined. The impact of the high efficiency multibandgap solar array on the reference concept design is considered. System trade studies for several solid state concepts, including the sandwich concept and a separate antenna/solar concept, are described. Two solid state concepts were selected and a design definition is presented for each. Magnetrons as an alternative to the reference klystrons for dc/RF conversion are evaluated. System definitions are presented for the preferred klystron and solid state concepts. Supporting systems are analyzed, with major analysis in the microwave, structures, and power distribution areas. Results of studies for thermal control, attitude control, stationkeeping, and details of a multibandgap solar cell study are included. Advanced laser concepts and the meteorological effects of a laser beam power transmission concept are considered. J.D.H.

N81-21492*# Rockwell International Corp., Downey, Calif.

SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). VOLUME 4, PART 2: COST AND PROGRAMMATICS APPENDIX Final Report

G. M. Hanley Washington NASA Mar. 1981 401 p 7 Vol.
(Contract NAS8-32475)
(NASA-CR-3398; SSD-80-0108-6-2) Avail: NTIS HC A18/MF A01 CSCL 10A

Cost and programmatic aspects of a recommended satellite power system are documented. Computer generated summaries are presented, and the detailed computer runs structured in a Work Breakdown Structure are given. The six configurations developed during the study period are summarized. J.D.H.

N81-21493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE 1980 GODDARD SPACE FLIGHT CENTER BATTERY WORKSHOP

G. Halpert Mar. 1981 426 p Proceedings of workshop held at Greenbelt, Md., 18-20 November 1980
(NASA-CP-2177) Avail: NTIS HC A19/MF A01 CSCL 10C

Several aspects of lithium primary cell technology are discussed with respect to aerospace application. Particular attention is given to the statistical analysis of battery data and accelerated testing. For individual titles, see N81-21494 through N81-21532.

N81-21494*# Honeywell Power Sources Center, Horsham, Pa.

Li/SO2 CELL FOR GALILEO

L. J. Blagdon and Lynn Marcoux (Hughes Aircraft Co., Los Angeles) *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 13-22 *(For primary document see N81-21493 12-44)*
Avail: NTIS HC A19/MF A01 CSCL 10C

Some information on the special process controls for lithium sulfur dioxide (Li/SO2) batteries is presented with reference to how those controls affected the Galileo probe program and the instrument test vehicle program. The general considerations that go into any application for basically any type of battery system are discussed. Particular emphasis is given to some of the design tradeoffs which resulted because of the addition of the safety characteristics of the Li/SO2 system. R.C.T.

N81-21495*# Electrochem Industries, Inc., Clarence, N.Y.
PERFORMANCE AND SAFETY CHARACTERISTICS OF Li/BCX AND L/CSC SYSTEMS
Robert M. Murphy *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 23-30 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The performance and safety characteristics of the lithium BMX and lithium CSC battery system are discussed. A comparison is made between the two systems with respect to open circuit voltage, energy density, and operating temperature. R.C.T.

N81-21496*# Honeywell Corporate Technology Center, Bloomington, Minn.
THERMAL MODELING OF LITHIUM SYSTEMS
Kwang Yil Kim *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 31-37 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The heat generation during cell discharge and its distribution are discussed. The effects of casing materials, thickness of current collectors, discharge environments, and entropies are described. A number of calorimetric experiments are described which quantify the heat during cell discharge. R.C.T.

N81-21497*# Bedford Engineering Corp., Alexandria, Va.
Li/SO2 CELL LOT TO LOT VARIATIONS AND SOME DESIGN COMPARISONS
C. Richard Walk *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 39-45 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Data collected from an investigation of Li/SO2 cells are presented. Two different cell designs are discussed: the standard cell, which has very high Li/SO2 ratios (1.5 or 2:1); and the balanced design, where the Li/SO2 ratio is 0.9:1 on an ampere hour basis. R.C.T.

N81-21498*# Sandia Labs., Albuquerque, N. Mex.
LONG LIFE Li/SO2 CELLS
Samuel Levy *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 47-55 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The development of a long life Li/SO2 battery (one that could operate continuously for periods of at least five years) is discussed. The causes of premature failures in battery concepts are defined and solutions to these problems are described. In particular the corrosion of the glass in a glass-to-metal seal and a spot welded positive lead are addressed. M.G.

N81-21499*# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J. Power Sources Div.
PERFORMANCE STORAGE, SAFETY AND DISPOSAL OF Li/SO2 CELLS
Gabriel J. DiMasi and John A. Christopoulos *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 61-71 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Cell performance characteristics after storage at room temperature and 71 C as well as some cell failure modes are evaluated. The performance of cells at low temperatures (-30 C) even into voltage reversal is also considered. The correlation of Li/SO2 coulombic ratio with generated free cyanide (CN-) in forced discharged D cells is also included. M.G.

N81-21500*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
Li/SO2 CELL PERFORMANCE
James S. Cloyd *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 73-89 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The development of a Li/SO2 cell exhibiting intermittent storage capability at 98 C and instantaneous voltage response is discussed. Results of short circuit, cell puncture, and forced discharge testing are presented along with elevated temperature storage and temperature cycling responses. M.G.

N81-21501*# Naval Surface Weapons Center, White Oak, Md.
ALTUS SMALL BUTTON CELL PERFORMANCE
Carol Freeman, Frank Bis, and Donald L. Warbutton *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 91-97 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Results of testing performed on Altus lithium thionyl chloride cells are presented. The test plan followed simulates the mine environment. It involves nondestructive testing, ruggedness testing and destructive testing. The nondestructive testing involves open circuit voltage measurements initially on all the cells, alternating current resistance measurements initially on all the cells and closed circuit voltage pulses, 20s on and 20s through 1000, 100, 10 and 1 ohms at temperatures of -54 to 71 C. The ruggedness testing involves low frequency vibration, high frequency vibration, and two-phase water entry shock at temperatures of -54, 25 and 71 C. It also involves thermal shock tests. M.G.

N81-21502*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CATASTROPHIC EVENT MODELING
Harvey A. Frank *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 99-103 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

A mathematical model for the catastrophic failures (venting or explosion of the cell) in lithium thionyl chloride batteries is presented. The phenomenology of the various processes leading to cell failure is reviewed. M.G.

N81-21503*# Naval Surface Weapons Center, White Oak, Md.
CARBON CATALYSIS OF REACTIONS IN THE LITHIUM SOCl2 AND SO2 SYSTEMS
William P. Kilroy *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 105-110 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Certain hazards associated with lithium batteries have delayed widespread acceptance of these power sources. The reactivity of ground lithium carbon mixtures was examined. The effect of carbon types on this reactivity was determined. The basic reaction involved mixtures of lithium and carbon with battery electrolyte. The various parameters that influenced this reactivity included: the nature and freshness of the carbon; the freshness, the purity, and the conductive salt of the electrolyte; and the effect of Teflon or moisture. T.M.

N81-21504*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SAFETY TESTING OF LITHIUM CELLS
Jim Bene *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 111-117 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The testing consisted of a forced discharge to zero volts constant current under isothermal conditions. The temperature range was -40 to 65 C. Short circuit tests, drop tests, and puncture tests were run to determine how a cell might behave if it developed a leak. Once the sulfur dioxide is exhausted, a

lithium acetontirile reaction occurs. An excess of sulfur dioxide must be maintained in order to avoid chemical explosions. T.M.

N81-21505*# Hughes Aircraft Co., Los Angeles, Calif.
HIGH ENERGY DENSITY BATTERIES FOR SATELLITE APPLICATIONS
Lynn Marcoux and R. Marsh (Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio) *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 143-154 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The performance requirements of high-energy batteries for terrestrial applications were examined to establish whether or not these systems showed any promise in aerospace applications. The technology assessment is reported and consists of a battery technology evaluation, preliminary engineering studies, and system selection. Major candidate systems are compared and a program schedule is provided. T.M.

N81-21506*# Bell Telephone Labs., Inc., Murray Hill, N. J.
THE STRUCTURES OF THE SINTERED PLAQUE IN THE NICKEL HYDROXIDE ELECTRODE
B. Vyas *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 157-164 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The various failure mechanisms were identified for the nickel electrode. The nickel sinter is involved in all these failure modes. The first one, chemical attack by carbonate, nitrate or other electrolyte components, involves corrosion of the nickel sinters. The second is the physical mode, which involves swelling of the electrode and physical shifting of the sinter in the electrodes. The third is the mechanical failure mode, and is due to fatigue or to the oxygen pressure that causes deformation or fracture of the sinter. T.M.

N81-21507*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
INITIAL CAPACITY CONDITIONING ON ELECTROCHEMICAL NICKEL HYDROXIDE ELECTRODES
David H. Fritts *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 165-173 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Conditioning is the initial cycling where cell capacity is usually unstable. The causes of the initial capacity build were examined. Gridless electrodes were fabricated to ensure mechanical homogeneity, so that a strain measured in one direction would be typical of a strain measured in the other directions. Plate hardness was also determined. These two parameters stabilize together. T.M.

N81-21508*# Hughes Research Labs., Malibu, Calif.
EXPANSION OF THE NICKEL ELECTRODE
Hong S. Lim *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 175 - 181 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

To observe a reasonable amount of expansion, months or years in acutal batteries are required. Therefore, the technique of electrode bending was developed. Active material is taken off a sample electrode on one side, and left only on the other side with a cadmium counter electrode. With this configuration, if the active material expands, the electrode will bend convex - concave towards this direction. This very small bending may be easily detected with light deflection. A laser beam was used to project it on the screen through a mirror attached on the electrode, thus making a very sensitive measurement of a very small expansion. T.M.

N81-21509*# MPD Technology Corp., Wyckoff, N.J.
THE CMG NICKEL ELECTRODE
Robert A. DePaul and Ian Gutridge *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 183-195 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The development and design of the Controlled Microgeometry electrode are described. Advantages of the electrode over others in existance include a higher number of ampere hours per kilogram and the ability to make them over a wide range of thicknesses. The parameters that control the performance of the electrode can be individually controlled over a wide range. Therefore, the electrode may be designed to give the optimum performance for a given duty cycle. T.M.

N81-21510*# Naval Surface Weapons Center, White Oak, Md.
LIGHTWEIGHT COMPOSITE CADMIUM ELECTRODES
R. A. Sutula and W. Ferrando *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 197-205 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The design and fabrication of the electrodes are discussed. The electrode efficiency of different impregnations of plaques is reported. The chemical impregnation for commercial use has the lowest efficiency, and for aerospace application it has higher efficiency. The electrochemically impregnated electrode is the most efficient. T.M.

N81-21511*# Coppin State Coll., Baltimore, Md.
ELECTROLYTE DISTRIBUTION STUDY IN SEALED NICKEL CADMIUM CELLS
Vasanth L. Kunigahalli *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 207-215 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The purpose of the study was threefold: to find an alternative method of estimating and extracting the electrolyte content in a cell; to understand how the electrolyte is distributed in the cell components (the positives and the negatives and in the separator material); and to discover whether the electrolyte is associated mostly with the positives and negatives or the separator. In each that cell the negative was associated with the greatest proportion of electrolyte, followed by the positive, and the separator. T.M.

N81-21512*# Hughes Research Labs., Malibu, Calif.
PBI TREATED POLYPROPYLENE BATTERY SEPARATOR
Scott A. Veryzwyvelt *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 217-223 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

A generalized procedure for fabricating the separator is described. Some of the desired properties considered in fabricating the separator material for nickel-cadmium cells were good mechanical strength, good chemical stability, good wettability to the electrolyte, high electrolyte retention, and gas passage. T.M.

N81-21513*# Eagle-Picher Industries, Inc., Joplin, Mo.
LIGHTWEIGHT 50A H CASE DESIGN
Lee Miller *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 225-228 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Reduction of weight in the cell container and incorporation of compression seals are described. Design geometry is standard NASA 50A h geometry. The unit was pressurized to 100 psig. The yield point was not achieved. The case weighs 150 g. S.F.

N81-21514*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ANATOMY OF A SHORT
Willard R. Scott *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 229-240 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The plate stocks of nickel cadmium batteries were disassembled to locate shorts. Through testing, the cause of the shorts was discovered to be a growth of cadmium coming through the separator. S.F.

N81-21515*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ACCEPTANCE TESTS AND MANUFACTURER RELATIONSHIPS FROM THE 20A H STANDARD CELL DATA
Harold F. Leibecki *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 243-255 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Seventeen performance tests were used to classify spacecraft batteries in four standard groups established by manufacturers. Tests included capacity delivered values, end of charge voltage values, and internal shorts. Variance ratios are listed. S.F.

N81-21516*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BATTERY FAILURE MODEL DERIVED FROM FLAW THEORY
Irwin Schulman *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 257-264 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

A previously derived failure model for battery lifetime is discussed in terms of growth rate of the flaw, distribution of flaw sizes, and number of flaws. Equations are presented for determining the failure model for a nickel cadmium battery. S.F.

N81-21517*# Coppin State Coll., Baltimore, Md.
ACCELERATED TESTING FOR SYNCHRONOUS ORBITS
Patrick McDermott *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 265-281 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Degradation of batteries during synchronous orbits is analyzed. Discharge and recharge rates are evaluated. The functional relationship between charge rate and degradation is mathematically determined. S.F.

N81-21518*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPEARANCE OF SECOND PLATEAU VOLTAGE
Gerald Halpert *In its* The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 305-315 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Batteries used in TIROS N and NOAA A spacecraft were performance tested. Voltage levels are plotted in a series of graphs. Cell packs from four different manufacturers are evaluated for depth of charge. S.F.

N81-21519*# General Electric Co., Philadelphia, Pa.
DSCS III BATTERY TESTS
H. E. Thierfelder *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 317-327 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Batteries for use in the Defense Communications Satellite System were life tested. Charge current is assessed in terms of eclipse periods. S.F.

N81-21520*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
NICKEL CADMIUM CELL OPTIMIZATION PROGRAM
Douglas Hafen *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 329-333 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Battery selection was based on tests to evaluate: weight, capacity; overcharge capability at varying temperatures; and charge retention. S.F.

N81-21521*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTIMISSION MODULAR SPACECRAFT PARALLEL BATTERY TESTS
Michael Tasevoli *In its* The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 335-341 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Acceptance test data included: voltage profiles; pressure increase or decrease; and response of the third electrode cell. A softening of the voltage profile was revealed, as well as a lowering of the discharge profile and a 10 percent loss of capacity over a 0 to 20 C temperature range. S.F.

N81-21522*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PREDELIVERY CELL AND BATTERY SUMMARY FOR SMM 20A H BATTERIES
Donald A. Webb *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 343-347 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Nickel cadmium batteries were performance tested and found to be compatible with the demands and goals of the Solar Maximum Mission flights. S.F.

N81-21523*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR MAXIMUM MISSION (SMM) IN-FLIGHT PERFORMANCE
Richard J. Broderick *In its* The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 349-359 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The modular power system is discussed. Typical and analytical orbit data are compared with life test data for the batteries. E.D.K.

N81-21524*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING LANDER FIVE YEAR SUMMARY
Alfred Britting *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 361-370 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The battery assemblies in the Viking lander are discussed. Discharge and recharge schemes are described. Performance charts for the batteries are included. E.D.K.

N81-21525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF DIFFERENT PLATE TREATMENTS AND DESIGNS, AN UPDATE
Dave Baer *In its* The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 371-378 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Nine packs of cells of different designs were put on test at Crane. They were run through their initial evaluation tests and then put into a cycling test. These were GE 12A h cells. The temperature was 20 C, the orbit was 90 minutes, the depth of discharge was 40%, the discharge rate was 9.6A and the initial charge rate was 9.6A to a voltage limit where it went into a taper. The goal was to get 100% return. The voltage limit was 1.453V through most of the testing, although recently it became necessary to lower some packs and raise some to hold 115% return. After one year, one cell from each pack was removed and the initial evaluation tests were repeated. E.D.K.

N81-21526*# RCA Labs., Princeton, N. J.
RCA SATCOM IN-ORBIT EXPERIENCE
David Stewart *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 379-384 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The F1 and F2 spacecraft battery systems are described. Battery reconditioning and discharge are discussed and graphically illustrated. Current sharing as a measure of battery performance is also plotted. E.D.K.

N81-21527*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIR FORCE NICKEL HYDROGEN CELLS
Don R. Warnock *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 387-389 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

A 3.5 in. diameter, nominal 15A h cell went into advanced

development in 1976 and is still in advanced development. The development of common pressure vessel nickel hydrogen modules is explored. The concept is to put a number of nickel hydrogen cells into one pressure vessel. There is a very modest advantage in terms of weight energy density, but a substantial advantage in both volume energy density and cost. E.D.K.

N81-21528*# Eagle-Picher Industries, Inc., Joplin, Mo.
NICKEL HYDROGEN CELLS, AN HISTORIC OVERVIEW
Lee Miller *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 391-397 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The development of the nickel hydrogen battery system was primarily for replacement of the nickel cadmium battery and for space power systems. A chronological review of the major events and milestones leading up to the current system status is summarized. E.D.K.

N81-21529*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
NICKEL HYDROGEN LIFE CYCLE TEST RESULTS
Martin G. Gandel *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 339-407 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The charge efficiency of nickel hydrogen batteries is discussed. The general characteristics of the battery life cycle are described with respect to the dissipation of heat from the battery. R.C.T.

N81-21530*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
NICKEL HYDROGEN CELL TESTS
Vernon C. Mueller *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 409-418 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

Some parametric tests followed by cycling tests are described for the characterization of the service life of nickel hydrogen cells. Three cells were automatically cycled in simulated low Earth orbit in 35 minute discharge, 55 minute charge, with charging voltage limited, temperature compensated. The cells were mounted in a fixture that conducts heat to an aluminum baseplate. The baseplate in turn, is bounded in a temperature controlled bath to remove the heat from the mounted fixture. One cell was tested with a zircar separator, which failed after 2473 cyles. Two other cells were tested one with a zircar separator; the other with asbestos. More than 400 cycles were achieved. R.C.T.

N81-21531*# EIC, Inc., Newton, Mass.
COMMON PRESSURE VESSEL DEVELOPMENT FOR THE NICKEL HYDROGEN TECHNOLOGY
Gerhard Holleck *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 419-429 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

The design of a pressure vessel nickel hydrogen cell is described. The cell has the following key features: it eliminates electrolyte bridging; provides for independent electrolyte management for each unit stack; provides for independent oxygen management for each unit stack; has good heat dissipation; has a mechanically sound and practical interconnection; and has the maximum in common with state of the art individual pressure vessel technology. M.G.

N81-21532*# Hughes Aircraft Co., Los Angeles, Calif.
CAPACITY OF A NICKEL HYDROGEN BOILERPLATE CELL AS A FUNCTION OF TEMPERATURE
Howard H. Rodgers, P. J. Dalton, and L. A. Tinker *In* NASA. Goddard Space Flight Center The 1980 Goddard Space Flight Center Battery Workshop Mar. 1981 p 431-437 (For primary document see N81-21493 12-44)
Avail: NTIS HC A19/MF A01 CSCL 10C

An evaluation of the components was conducted with special emphasis on positive electrodes. Electrochemically impregnated positive electrodes were used which were made on a slurry plaque by using a perforated steel substrate. The capacity of the test cell was consistent with the loading level used and the effect of temperature on capacity seems to depend on the cobalt level. T.M.

N81-21533*# Mathtech, Inc., Arlington, Va.
STUDY OF FUEL CELL ON-SITE, INTEGRATED ENERGY SYSTEMS IN RESIDENTIAL/COMMERCIAL APPLICATIONS Final Report
R. A. Wakefield, S. Karamchatty, R. H. Rand, W. S. Ku, and V. Tekumalla Oct. 1980 310 p refs
(Contracts DEN3-89; DE-AI03-79ET-11272)
(NASA-CR-165144; DOE/NASA-0089-80/1; E-FC-002) Avail: NTIS HC A14/MF A01 CSCL 10A

Three building applications were selected for a detailed study: a low rise apartment building; a retail store, and a hospital. Building design data were then specified for each application, based on the design and construction of typical, actual buildings. Finally, a computerized building loads analysis program was used to estimate hourly end use load profiles for each building. Conventional and fuel cell based energy systems were designed and simulated for each building in each location. Based on the results of a computer simulation of each energy system, levelized annual costs and annual energy consumptions were calculated for all systems. T.M.

N81-21534*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY (EXHIBIT D). SOLID-STATE AMPLIFIER INVESTIGATION Final Report
G. M. Hanley Washington NASA Apr. 1981 102 p refs
(Contract NAS8-32475)
(NASA-CR-3400; SSD-80-0120) Avail: NTIS HC A06/MF A01 CSCL 10A

Data resulting from a continuing effort to provide system/subsystem definition data to aid in the evaluation of the SPS program concept is presented. The specific data described relate to the proposed use of solid state devices as microwave power amplifiers in the satellite microwave power transmission subsystem. R.C.T.

N81-21535*# La Quinta Motor Inns, Inc., San Antonio, Tex.
SOLAR HOT WATER SYSTEM INSTALLED AT LAS VEGAS, NEVADA Final Report
Jan. 1981 40 p refs Sponsored by NASA
(Grant EG-77-G-01-1654)
(NASA-CR-161642) Avail: NTIS HC A03/MF A01 CSCL 10A

A solar energy hot water system installed in a motor inn at Las Vegas, Nevada is described. The inn is a three story building with a flat roof for installation of the solar panels. The system consists of 1,200 square feet of liquid flat plate collectors, a 2,500 gallon insulated vertical steel storage tank, two heat exchangers, and pumps and controls. The system was designed to supply approximately 74 percent of the total hot water load. M.G.

N81-21536*# Energy Research Corp., Danbury, Conn.
TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT, PHASE 2 Quarterly Report
Larry Christner Mar. 1980 74 p
(Contracts DEN3-67; DE-AL03-79ET-11272)
(NASA-CR-165317; DOE/NASA/0067-79-3; ERC-18; QR-6)
Avail: NTIS HC A04/MF A01 CSCL 10A

The technology development for materials, cells, and reformers for on site integrated energy systems is described. The carbonization of 25 cu cm, 350 cu cm, and 1200 cu cm cell test hardware was accomplished and the performance of 25 cu cm fuel cells was improved. Electrochemical corrosion rates of graphite/phenolic resin composites in phosphoric acid were determined. Three cells (5 in by 15 in stacks) were operated for longer than 7000 hours. Specified endurance stacks completed a total of 4000 hours. An electrically heated reformer was tested and is to provide hydrogen for 23 cell fuel cell stack. R.C.T.

N81-21537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA-LERC WIND TURBINE SOUND PREDICTION

CODE
Larry A. Viterna 1981 10 p refs Presented at Second DOE/NASA Wind Turbine Dyn. Workshop, Cleveland, 24-26 Feb. 1981
(Contract DE-AI01-76ET-20366)
(NASA-TM-81737; DOE/NASA/20366-1; E-808) Avail: NTIS HC A02/MF A01 CSCL 10B

Development of the wind turbine sound prediction code began as part of an effort understand and reduce the noise generated by Mod-1. Tone sound levels predicted with this code are in good agreement with measured data taken in the vicinity Mod-1 wind turbine (less than 2 rotor diameters). Comparison in the far field indicates that propagation effects due to terrain and atmospheric conditions may amplify the actual sound levels by 6 dB. Parametric analysis using the code shows that the predominant contributors to Mod-1 rotor noise are (1) the velocity deficit in the wake of the support tower, (2) the high rotor speed, and (3) off-optimum operation. S.F.

N81-21538*# United Technologies Research Center, East Hartford, Conn.
APPLICATIONS STUDY OF ADVANCED POWER GENERATION SYSTEMS UTILIZING COAL-DERIVED FUELS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Fred L. Robson Mar. 1981 21 p
(Contract NAS8-33996)
(NASA-CR-161691; R81-9955343-9-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 10B

The technology status of phosphoric acid and molten carbon fuel cells, combined gas and steam turbine cycles, and magnetohydrodynamic energy conversion systems was assessed and the power performance of these systems when operating with medium-Btu fuel gas whether delivered by pipeline to the power plant or in an integrated mode in which the coal gasification process and power system are closely coupled as an overall power plant was evaluated. Commercially available combined-cycle gas turbine systems can reach projected required performance levels for advanced systems using currently available technology. The phosphoric acid fuel cell appears to be the next most likely candidate for commercialization. On pipeline delivery, the systems efficiency ranges from 40.9% for the phosphoric acid fuel cell to 63% for the molten carbonate fuel cell system. The efficiencies of the integrated power plants vary from approximately 39-40% for the combined cycle to 46-47% for the molden carbonate fuel cell systems. Conventional coal-fired steam stations with flue-gas desulfurization have only 33-35% efficiency. A.R.H.

N81-21539*# United Technologies Research Center, East Hartford, Conn.
APPLICATIONS STUDY OF ADVANCED POWER GENERATION SYSTEMS UTILIZING COAL-DERIVED FUELS, VOLUME 2 Final Report
Fred L. Robson Mar. 1981 402 p refs
(Contract NAS8-33996)
(NASA-CR-161692; R81-9955343-9-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 10B

Technology readiness and development trends are discussed for three advanced power generation systems: combined cycle gas turbine, fuel cells, and magnetohydrodynamics. Power plants using these technologies are described and their performance either utilizing a medium-Btu coal derived fuel supplied by pipeline from a large central coal gasification facility or integrated with a gasification facility for supplying medium-Btu fuel gas is assessed. A.R.H.

N81-21540*# Crystal Systems, Inc., Salem, Mass.
SILICON INGOT CASTING--HEAT EXCHANGER METHOD (HEM) MULTI-WIRE SLICING--FIXED ABRASIVE SLICING TECHNIQUE (FAST) PHASE 4: SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE AREA SHEET TASK OF THE LOW-COST SOLAR ARRAY PROJECT Quarterly Progress Report
F. Schmid Feb. 1981 45 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954373)
(NASA-CR-164163; DOE/JPL-954373-80/18; JPL-9950-525; QPR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

The crystallinity of large HEM silicon ingots as a function of heat flow conditions is investigated. A balanced heat flow at the bottom of the ingot restricts spurious nucleation to the edge of the melted-back seed in contact with the crucible. Homogeneous resistivity distribution over all the ingot has been achieved. The positioning of diamonds electroplated on wirepacks used to slice silicon crystals is considered. The electroplating of diamonds on only the cutting edge is described and the improved slicing performance of these wires evaluated. An economic analysis of value added costs of HEM ingot casting and band saw sectioning indicates the projected add on cost of HEM is well below the 1986 allocation. J.D.H.

N81-21541*# Spectrolab, Inc., Sylmar, Calif.
SILICON SOLAR CELL PROCESS DEVELOPMENT, FABRICATION AND ANALYSIS Final Report
Joseph A. Minahan 9 Mar. 1981 75 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-955055)
(NASA-CR-164164; DOE/JPL-955055-81/6; JPL-9950-523) Avail: NTIS HC A04/MF A01 CSCL 10A

The fabrication of solar cells from several unconventional silicon materials is described, and cell performance measured and analyzed. Unconventional materials evaluated are edge defined film fed grown (EFG), heat exchanger method (HEM), dendritic web grown, and continuous CZ silicons. Resistivity, current voltage, and spectral sensitivity of the cells were measured. Current voltage was measured under AM0 and AM1 conditions. Maximum conversion efficiencies of cells fabricated from these and other unconventional silicons were compared and test results analyzed. The HEM and continuous CZ silicon were found to be superior to silicon materials considered previously. J.D.H.

N81-21542*# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
LOW COST SOLAR ARRAY PROJECT PRODUCTION PROCESS AND EQUIPMENT TASK. A MODULE EXPERIMENTAL PROCESS SYSTEM DEVELOPMENT UNIT (MEPSDU) Quarterly Report, 26 Nov. 1980 - 28 Feb. 1981
28 Feb. 1981 38 p Prepared for JPL
(Contract JPL-955909)
(NASA-CR-164173; JPL-9950-516; DOE/JPL-955909-81/1; QR-1) Avail: NTIS HC A03/MF A01 CSCL 10A

Technical readiness for the production of photovoltaic modules using single crystal silicon dendritic web sheet material is demonstrated by: (1) selection, design and implementation of solar cell and photovoltaic module process sequence in a Module Experimental Process System Development Unit; (2) demonstration runs; (3) passing of acceptance and qualification tests; and (4) achievement of a cost effective module. S.F.

N81-21543*# Energy Materials Corp., Harvard, Mass.
LOW COST SOLAR ARRAY PROJECT 1: SILICON MATERIAL
D. N. Jewett, H. E. Bates, and D. M. Hill 1980 25 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-955269)
(NASA-CR-164162; DOE/JPL-955269-80/5; JPL-9950-515; QPR-5) Avail: NTIS HC A02/MF A01 CSCL 10A

The low cost production of silicon by deposition of silicon from a hydrogen/chlorosilane mixture is described. Reactor design, reaction vessel support systems (physical support, power control and heaters, and temperature monitoring systems) and operation of the system are reviewed. Testing of four silicon deposition reactors is described, and test data and consequently derived data are given. An 18% conversion of trichlorosilane to silicon was achieved, but average conversion rates were lower than predicted due to incomplete removal of byproduct gases for recycling and silicon oxide/silicon polymer plugging of the gas outlet. Increasing the number of baffles inside the reaction vessel improved the conversion rate. Plans for further design and process improvements to correct the problems encountered are outlined. J.D.H.

N81-21544*# Mobil Tyco Solar Energy Corp., Waltham, Mass.
LARGE AREA SILICON SHEET BY EFG Quarterly Report, 1 Oct. 1980 - 31 Dec. 1980
17 Feb. 1981 38 p ref

(Contract JPL-954355)
(NASA-CR-164138; DOE/JPL-954355-80/16; JPL-9950-513; QR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

The development of a technique for the production of silicon ribbon is discussed. Extensive characterization of the multiple ribbon Furnace 3A main zone temperature profile was performed and the information used to improve uniformity of heating. Irregularities in the main zone heater were associated with growth difficulties at specific cartridge locations, and growth conditions subsequently improved by profiling the main zone heater. Good growth conditions were established in all three cartridge positions. These improvements allowed multiple growth of three 10 cm wide ribbons to be demonstrated for periods of an hour on several occasions. A gas distribution system for the 10 cm cartridge was introduced and demonstrated to lead to improved ambient control during growth. Growth without and with CO2 showed that quality improvement in 10 cm ribbon grown with cold shoes results from ambient manipulation. M.G.

N81-21545*# Westinghouse Research and Development Center, Pittsburgh, Pa.
LARGE AREA SHEET TASK. ADVANCED DENDRITIC WEB GROWTH DEVELOPMENT Quarterly Report, 23 Oct. 1980 - 31 Dec. 1980
C. S. Duncan, R. G. Seidensticker, J. P. McHugh, R. H. Hopkins, D. Meier, E. Frantti, and J. Schruben 31 Jan. 1981 37 p refs Sponsored by DOE Prepared for JPL
(Contract JPL-955843)
(NASA-CR-164136; DOE/JPL-955843-81/1) Avail: NTIS HC A03/MF A01 CSCL 10A

The development of a silicon dendritic web growth machine is discussed. Several refinements to the sensing and control equipment for melt replenishment during web growth are described and several areas for cost reduction in the components of the prototype automated web growth furnace are identified. A circuit designed to eliminate the sensitivity of the detector signal to the intensity of the reflected laser beam used to measure melt level is also described. A variable speed motor for the silicon feeder is discussed which allows pellet feeding to be accomplished at a rate programmed to match exactly the silicon removed by web growth. M.G.

N81-21546*# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
SILICON-ON-CERAMIC PROCESS: SILICON SHEET GROWTH AND DEVICE DEVELOPMENT FOR THE LARGE-AREA SILICON SHEET TASK OF THE LOW-COST SOLAR ARRAY PROJECT Annual Report, 29 Sep. 1979 - 30 Sep. 1980
A. B. Whitehead, J. D. Zook, B. L. Grung, J. D. Heaps, F. Schmit, S. B. Schuldt, and P. W. Chapman 5 Jan. 1981 79 p refs Sponsored by NASA and DOE Prepared for JPL
(Contract JPL-954356)
(NASA-CR-164134; DOE/JPL-954356-80/14; JPL-9950-495; AR-5) Avail: NTIS HC A05/MF A01 CSCL 10A

The technical feasibility of producing solar cell quality sheet silicon to meet the DOE 1986 cost goal of 70 cents/watt was investigated. The silicon on ceramic approach is to coat a low cost ceramic substrate with large grain polycrystalline silicon by unidirectional solidification of molten silicon. Results and accomplishments are summarized. T.M.

N81-21547*# Energy Research Corp., Danbury, Conn.
TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT (PHASE 2) Quarterly Report
Larry Christner Dec. 1979 52 p refs
(Contracts DEN3-67; DE-AI03-79ET-11272)
(NASA-CR-165316; DOE/NASA/0067-79/2; QR-5) Avail: NTIS HC A04/MF A01 CSCL 10A

The status of technology for the manufacturing and testing of 1200 sq. cm cell materials, components, and stacks for on-site integrated energy systems is assessed. Topics covered include: (1) preparation of thin layers of silicon carbide; (2) definition and control schemes for volume changes in phosphoric acid fuel cells; (3) preparation of low resin content graphite phenolic resin composites; (4) chemical corrosion of graphite-phenolic resin composites in hot phosphoric acid; (5) analysis of electrical resistance of composite materials for fuel cells; and (6) fuel cell performance and testing. A.R.H.

N81-21548*# Energy Research Corp., Danbury, Conn.
TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT (PHASE 2) Quarterly Report
Larry Christner Mar. 1980 75 p refs
(Contracts DEN3-67; DE-AI03-79ET-11272)
(NASA-CR-165317; DOE/NASA/0067-79/3; QR-6) Avail: NTIS HC A04/MF A01 CSCL 10A

Progress is reported in the development of technology for materials, cell components, and reformers for on-site integrated energy systems. Carbonization of 25 sq. cm, 350 sq. cm, and 1200 sq. cm cell test hardware was accomplished. The performance of 25 sq cm fuel cells was improved by using this material. Electrochemical corrosion rates of graphite phenolic resin composites in phosphoric acid were determined. Three cell, 5 in. by 15 in. stacks operated for more than 7,000 hours. Specified endurance stacks completed 4,000 hours. A electrically heated reformer to provide hydrogen for a 23 cell fuel cell stack was tested. A.R.H.

N81-21549# Naval Coastal Systems Center, Panama City, Fla.
TEST RESULTS OF HEAT EXCHANGER CLEANING IN SUPPORT OF OCEAN THERMAL ENERGY CONVERSION Technical Memorandum, Sep. 1978 - May 1980
Daniel F. Lott Dec. 1980 283 p refs Sponsored in cooperation with DOE
(AD-A096343; NCSC-TM-298-80) Avail: NTIS HC A13/MF A01 CSCL 13/1

This report documents tests conducted at the Naval Coastal Systems Center (NCSC) in support of the Department of Energy's Ocean Thermal Energy Conversion (OTEC) Program. These tests covered the period September 1978 to May 1980 and evaluated flow-driven brushes, recirculating sponge rubber balls, chlorination, and mechanical system/chlorination combinations for in-situ cleaning of two potential heat exchanger materials: titanium and aluminum alloy 5052. Tests were successful when fouling resistance was 0.0003 sq. ft. hr-F/Btu. Results indicated systems and cleaning techniques using brushes, soft sponge balls, and various concentrations of chlorine had some potential for maintaining heat transfer efficiency. GRA

N81-21550# Delegationen foer Energiforskning, Stockholm (Sweden).
PRODUCTION OF A RAW MATERIAL FOR ENERGY PRODUCTION IN AGRICULTURE
Goeran Hellstroem Apr. 1980 48 p refs In SWEDISH
(DFE-31) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The total amount of energy in products produced by Swedish agriculture was estimated to 80 TWH: 30 TWh for cereals, 15 TWh for grass and leguminosae, and 35 TWh for straw and other agricultural wastes. Of this production a large part will be used as food even in the future. New plants that would produce more energy than the ones traditionally grown in Sweden are discussed. Also other types of energy from agriculture are discussed such as methane from manure, methanol from gasification processes, and ethanol from fermentative processes. Costs were estimated from different alternatives. DOE

N81-21551# Styrelsen foer Teknisk Utveckling, Stockholm (Sweden).
ENERGY PRODUCTION FROM WASTE HEAT BY MEANS OF ELASTOMERS OR MEMORY METALS
Lars Ljung May 1980 49 p refs In SWEDISH
(STU-79-6394) Avail: NTIS HC A03/MF A01

Calculation of the energy of an ideal heat engine for a flow between waste water and cooling water was made. Also the Brayton, Carnot and Rankine cycles were computed as well as the processes with nitinol or elastomers as converters. It was shown that half the energy can be recovered by a nitinol heat engine which is comparable to or has better efficiency than the Rankine cycle. The memory metal makes better use of the temperature difference than the Rankine cycle. Elastomers or Gadolinium may be used to utilize energy at low waste heat temperatures. DOE

N81-21552# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: MOULDER CORPORATION, WEST GREENWOOD, INDIANA Progress Report, Oct. 1979 - Apr. 1980

C. Y. Whitehead 1980 74 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/1001-80/14) Avail: NTIS HC A04/MF A01

The performance of a single-family home which has 704 sq. ft. of air, flat-plate collectors and an 850 cu. ft. rock bin buried under the house is discussed. The system was designed to contribute 84% of the space heating and 100% of the water heating. Actual contributions were 17% of the hot water load and 21% of the space heating load. Problems with the systems are described. DOE

N81-21553# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

HULLCO CONSTRUCTION, PRESCOTT, ARIZONA: SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION OCTOBER 1979 - MAY 1980

Paul C. Miller and Edward Pollock 1980 88 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/1043-80/14) Avail: NTIS HC A05/MF A01

A single-family passive solar residence located in Prescott, Arizona was designed to supply 97 percent of the heating load. Included in the system is an attached greenhouse, a Trombe wall, rock bin, direct gain floor slab, and secondary storage in the building mass. The actual solar contribution was 91 percent in this colder than average season. DOE

N81-21554# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: KALWALL CORPORATION, MANCHESTER, NEW HAMPSHIRE Progress Report, Oct. 1979 - May 1980

J. W. Spears 1980 81 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/2015-80/14) Avail: NTIS HC A05/MF A01

The direct-gain passive solar energy system was designed to supply approximately 50% of the annual space heating demand. The addition of roof insulation has resulted in system performance which exceeds these design projections. The structure is equipped with 1750 sq. ft. of vertical south-facing glazing and 850 sq. ft. of vertical east-facing glazing. The storage system consists of 817,000 pounds of dark-colored concrete in the eight inch floor slab. Additional storage is in the materials stored in the warehouse. Auxiliary space heating is provided by two liquid-to-air heat exchangers supplied by the building boiler. DOE

N81-21555# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

TROY-MIAMI LIBRARY, TROY, OHIO: SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION Progress Report, Nov. 1979 - Apr. 1980

Stephen Dudzik 1980 77 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/2029-80/14) Avail: NTIS HC A05/MF A01

The solar system utilizes 3264 sq. ft. of Owens-Illinois Sunpak Shaped Reflector evacuated tube collectors and a 5000 gallon undergound steel-lined fiberglass water storage tank to heat the 23,000 sq. ft. building. The solar system performance can be briefly summarized: solar fraction, 31%; solar savings ratio, 0.20; conventional fuel savings, 11,421 kWh; system performance factor, 0.29; solar system COP, 2.96. DOE

N81-21556# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

***PERFORMANCE OF ACTIVE SOLAR DOMESTIC HOT WATER HEATING SYSTEMS* Progress Report, 1979 - 1980**

M. A. Cramer, P. W. Kendall, J. M. Rosenbusch, and R. A. Weinstein 1980 249 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/0024-80/41) Avail: NTIS HC A11/MF A01

The most recent composite results of analysis performed by Vitro Laboratories of solar hot water heating data for selected hot water sites in the National Solar Data Network (NSDN) are presented. Results presented were developed on the basis of analysis of instrumented sites monitored through 1979-1980. A total of 45 sites in the National Solar Data Network (NSDN) were examined for this study. Eighteen of these were selected for in-depth treatment because of the availability of valid long term data. System descriptions, schematic diagrams and energy flow diagrams for these 18 sites are presented. T.M.

N81-21557# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

SOLAR ENERGY SYSTEM PERFORMANCE EVALUATION: HEI WAI WONG, HONOLULU, HAWAII, NOVEMBER AND DECEMBER 1979 AND APRIL THROUGH AUGUST 1980

M. A. Cramer 1980 76 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/1014-80/14) Avail: NTIS HC A05/MF A01

The instrumented system consists of an array of flat-plate collectors with an area of 807.4 square feet. The collector and storage subsystem consists of a 1230-gallon storage tank mounted on the roof with the bottom of the tank slightly higher than the top of the collector panels. When the Sun heats the water in the collectors above the tank water temperature, a thermosiphon current is induced. When the temperature in storage exceeds the temperature of the water in the collectors, the thermosiphon flow ceases. The solar energy system at Hei Wai Wong supplied 98% of the energy required for hot water for the six apartments and the laundry. DOE

N81-21558# Curtiss-Wright Corp., Wood-Ridge, N.J. Power Systems Div.

DESIGN, CONSTRUCTION, OPERATION AND EVALUATION OF A PROTOTYPE CULM COMBUSTION BOILER/HEATER UNIT Technical Progress Report, 1 Apr. - 30 Jun. 1980

Aug. 1980 51 p

(Contract DE-AC21-78ET-12307)

(FE-3269-32; CW-WR-78-036.32A) Avail: NTIS HC A04/MF A01

The objectives of the program as well as the technical progress and problem areas encountered are presented. The progress on drawing preparation and procurement activity is discussed. Processing of the construction bid package and awarding of the contract is discussed. The prototype plant site was cleared and leveled, and boiler concrete foundations were installed. Stone roadways were completed. DOE

N81-21559# Princeton Univ., N. J. Center for Environmental Studies.

ALTERNATIVE ENERGY FACILITY SITING POLICIES FOR URBAN COASTAL AREAS: EXECUTIVE SUMMARY OF FINDINGS AND POLICY RECOMMENDATIONS

David Morell and Grace Singer Nov. 1980 29 p refs

(Contract DE-AS03-77EV-01528)

(DOE/EV-01528/T1) Avail: NTIS HC A03/MF A01

An analysis was made of siting issues in the coastal zone, one of the nation's most critical natural resource areas and one which is often the target for energy development proposals. The analysis addressed the changing perceptions of citizens toward energy development in the coastal zone, emphasizing urban communities where access to the waterfront and revitalization of waterfront property are of interest to the citizen. The case studies demonstrate the significance of local attitudes and regional cooperation in the siting process. DOE

N81-21560# Los Alamos Scientific Lab., N. Mex.

WATER SUPPLY AND DEMAND IN AN ENERGY SUPPLY MODEL

David Abbey and Verne Loose Dec. 1980 61 p refs

(Contract DE-AC04-80EV-10180)

(DOE/EV-10180/2) Avail: NTIS HC A04/MF A01

The model allows adjustments in the input mix and plant siting in response to water scarcity. Thus, on the demand side energy conversion facilities can substitute more costly dry cooling systems for conventional evaporative systems. On the supply side groundwater and water purchased from irrigators are available as more costly alternatives to unappropriated surface water. Water supply data is developed for 30 regions in 10 western states. Preliminary results for a 1990 energy demand scenario suggest that, at this level of spatial analysis, water availability plays a

minor role in plant siting. Future policy applications of the modeling system are discussed including the evaluation of alternative patterns of synthetic fuels development. DOE

N81-21561# Battelle Columbus Labs., Ohio.
ANALYSIS OF FIELD TEST DATA ON RESIDENTIAL HEATING AND COOLING Final Report
S. G. Talbert Dec. 1980 129 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 1364-1)
(EPRI-EA-1649) Avail: NTIS HC A07/MF A01

The computer program using field site data collected on 48 homes located in six cities in different climatic regions of the United States is discussed. In addition, a User's Guide was prepared for the computer program which is contained in a separate two-volume document entitled User's Guide for REAP: Residential Energy Analysis Program. Feasibility studies were conducted pertaining to potential improvements for REAP, including: the addition of an oil-furnace model; improving the infiltration subroutine; adding active and/or passive solar subroutines; incorporating a thermal energy storage model; and providing dual HVAC systems (e.g., heat pump-gas furnace). The purpose of REAP is to enable building designers and energy analysts to evaluate how such factors as building design, weather conditions, internal heat loads, and HVAC equipment performance, influence the energy requirements of residential buildings. DOE

N81-21562# New Mexico State Univ., Las Cruces.
REGIONAL OPERATIONS RESEARCH PROGRAM FOR COMMERCIALIZATION OF GEOTHERMAL ENERGY IN THE ROCKY MOUNTAIN BASIN AND RANGE Final Report, 1 Aug. 1978 - 28 Feb. 1980
J. M. Marlin, Roy Cunniff, Paul McDevitt, Kenneth Nowotny, and Patrick ODea Jan. 1981 126 p Sponsored in part by New Mexico Energy and Minerals Dept. and Four Corners Regional Commission
(Contract DE-AS07-78ID-01756)
(DOE/ID-01756/T1; EMD-78-2236) Avail: NTIS HC A07/MF A01

The work accomplished from August 1978 to February 1980 in the Regional Operations Research efforts for the Rocky Mountain Basin and Range Geothermal Commercialization Program is described. The work included continued data acquisition and extension of the data base, enhancement and refinement of the economic models for electric and direct use applications, site-specific and aggregated analyses in support of the state teams and special analyses in support of several federal agencies. DOE

N81-21563# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
FUNDAMENTAL HEAT TRANSFER PROCESSES RELATED TO PHASE CHANGE THERMAL STORAGE MEDIA
E. M. Sparrow and J. W. Ramsey Jan. 1981 16 p refs
(Contract DE-AS02-79ER-10343)
(DOE/ER-10343/20) Avail: NTIS HC A02/MF A01

The extent to which freezing can be enhanced by the attachment of fins to the external surface of a cooled vertical tube situated in liquid phase-change medium was investigated. Solutions involving both the phase-change medium and the heat transfer fluid used either to add heat to or extract heat from the medium were obtained. For freezing on a plane wall, it was possible to obtain a closed-form analytical solution, while for freezing about a coolant-carrying circular tube, a new numerical methodology was devised to obtain finite-difference solutions. For melting, quantitative design-quality heat transfer coefficients were determined experimentally for melting adjacent to a heat vertical tube. DOE

N81-21564# California Univ., Livermore. Lawrence Livermore Lab.
WORLD ACTIVITY IN SOLAR PONDS
David W. Dorn 20 Jan. 1980 7 p refs
(Contract W-7405-eng-48)
(UCID-18900) Avail: NTIS HC A02/MF A01

The United States and Israel appear to be the only two countries actively developing solar salt gradient pond technology, which uses the pond water both as a direct absorber of solar energy and as a storage medium for the thermal energy collected. Current US pond projects and past, present, and future Israeli pond projects are presented. Israel, which is clearly leading in the development, has brought its research to a point considered near commercial and is beginning to market the technology in other countries. DOE

N81-21565# California Univ., Livermore. Lawrence Livermore Lab.
US ENERGY CONSUMPTION AND SUPPLY
C. M. VanAtta 13 Jan. 1981 44 p refs
(Contract W-7405-eng-48)
(UCID-18856) Avail: NTIS HC A03/MF A01

Energy consumption and cost in 1978 and 1979 are discussed with emphasis on the effect of imported oil on the economy of the United States. Some of the international aspects of energy supply are described, and actions to meet the probability of a cutoff of oil imports from the Persian Gulf area are suggested. Short and long range strategies for ensuring energy self sufficiency are discussed. A rationale for major, long range dependence on fission and fusion power is given, and the possible advantages of a nearly all electric energy system are mentioned. Projection of energy consumption and supply to the year 2020 based upon economic and demographic models is discussed. DOE

N81-21566# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
HANDBOOK OF EXPERIENCES IN THE DESIGN AND INSTALLATION OF SOLAR HEATING AND COOLING SYSTEMS
Dan S. Ward and Harjinder S. Oberoi Jul. 1980 231 p refs
(Contract DE-AC01-76CS-32224)
(DOE/CS-32224/T1) Avail: NTIS HC A11/MF A01

A large array of problems encountered are detailed, including design errors, installation mistakes, cases of inadequate durability of materials and unacceptable reliability of components, and wide variations in the performance and operation of different solar systems. Durability, reliability, and design problems are reviewed for solar collector subsystems, heat transfer fluids, thermal storage, passive solar components, piping/ducting, and reliability/operational problems. Performance topics covered include: criteria for design and performance analysis, domestic hot water systems, passive space heating systems, active space heating systems, space cooling systems, analysis of systems performance, and performance evaluations. DOE

N81-21567# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
THEORETICAL AND EXPERIMENTAL STUDY OF THE INTERMEDIATE FIELD DYNAMICS OF OCEAN THERMAL ENERGY CONVERSION PLANTS Progress Report, 1978 - 1979
Gerhard H. Jirka, Janet M. Jones, and Frank E. Sargent Mar. 1980 152 p refs Prepared in cooperation with MIT
(Contracts DE-AS02-78ET-20483; ET-78-S-02-4683)
(DOE/ET-20483/7) Avail: NTIS HC A08/MF A01

Results are described of a two-year research effort which was conducted with the following objectives: investigate analytically and experimentally the intermediate field spreading in a steady ocean current; investigate analytically and experimentally the transient intermediate field spreading in a stagnant ocean; compare the results with other available data on buoyancy driven currents in stratified surroundings, including the concurrent experimental program at MIT Parsons Laboratory; and use the results in the formulation of preliminary siting guidelines for multiple OTEC plant interactions. The theoretical background for the intermediate field spreading is given including both steady-state and transient results. DOE

N81-21568# Sandia Labs., Albuquerque, N. Mex.
MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PREDICTIONS FOR THERMAL PERFORMANCE OF THE ACUREX SOLAR COLLECTOR WITH FEK 244 REFLECTOR SURFACE
Thomas D. Harrison Jan. 1981 22 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1964/3) Avail: NTIS HC A02/MF A01

A detailed account of the methods used to make the predictions is given. The performance predictions are part of a program to measure the characteristics of commercially available solar collectors that have the potential for use in industrial process heat and enhanced oil recovery applications. T.M.

N81-21569# Sandia Labs., Albuquerque, N. Mex.
COMPUTER SUBROUTINE FOR ESTIMATING AERODYNAMIC BLADE LOADS ON DARRIEUS VERTICAL AXIS WIND TURBINES
W. N. Sullivan and T. M. Leonard Nov. 1980 36 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-2407) Avail: NTIS HC A03/MF A01

An important aspect of structural design of the Darrieus rotor is the determination of aerodynamic blade loads. A load generator was used for quasi-static and dynamic rotor analyses. The generator is based on the single streamtube aerodynamic flow model and is constructed as a FORTRAN IV subroutine to facilitate its use in finite element structural models. Input and output characteristics of the subroutine are described and a complete listing is attached as an appendix. DOE

N81-21570# Wisconsin Univ., Madison.
HIGH TEMPERATURE METALLIZATION SYSTEM FOR SOLAR CELLS AND GEOTHERMAL PROBES
J. D. Wiley, J. H. Perepezko, and J. E. Nordman Dec. 1980 56 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7167) Avail: NTIS HC A04/MF A01

Amorphous films of the alloys Ni-Nb, Ni-Mo, W-Si, and Mo-Si were deposited on semiconducting substrates by RF sputtering from composite cathodes. The films adhere extremely well to Si, GaAs, and GaP during and after thermal cycling from -2000 C to at least 5000 C. All films investigated to date remained amorphous during 1 hour anneals at 5000 C, and some alloy compositions were found which remain amorphous after annealing at greater than or equal to 5750 C. Rutherford backscatter analysis was used to study the diffusivity of Au in amorphous Ni-Nb. DOE

N81-21571# Sandia Labs., Albuquerque, N. Mex.
PHOTOVOLTAIC CONCENTRATOR TECHNOLOGY DEVELOPMENT PROJECT
Oct. 1980 306 p Presented at the 6th Project Integration Meeting, Albuquerque, N. Mex., 5-6 Nov. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-2373; CONF-801151) Avail: NTIS HC A14/MF A01

Thirty-three abstracts and short papers describe the current status of research, development, and demonstration of concentrator solar cell technology. Solar concentrations discussed include the parabolic trough, linear focus Fresnel lens, point focus Fresnel lens, and the parabolic dish. Solar cells studied include silicon, GaAs, and AlGaAs. Research on multiple junction cells, combined photovoltaic/thermal collectors, back contact solar cells, and beam splitter modules is described. Concentrator solar cell demonstration programs are reported. DOE

N81-21572# Los Alamos Scientific Lab., N. Mex.
PROSPECTS OF FUEL CELLS WITH ALKALINE, SOLID-POLYMER, AND SUPERACID ELECTROLYTES AS POWER SOURCES FOR ELECTRIC VEHICLES
S. Srinivasan 1981 38 p refs Presented at the Elec. and Hybrid Vehicle Advanced Technol. Seminar, Pasadena, Calif., 8-9 Dec. 1980 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-81-293; CONF-801242-1) Avail: NTIS HC A03/MF A01

The state of the art and expected progress with fuel cells using alternatives to phosphoric acid as the electrolyte, that is, alkaline, solid polymer, and superacid electrolytes is reviewed. Alkaline fuel cells are appealing because of the good performance at less than 1000 C and potential for finding nonnoble metal catalysts, but are handicapped by the fact that pure hydrogen will have to be stored and used as the fuel. The solid polymer electrolyte fuel cell has the best prospect for attaining the highest power densities, which are important from the point of view of reducing cost, weight, and volume of the power plant. However, this type of fuel cell uses an expensive electrolyte membrane and has a difficult water management problem. Enthusiasm is growing for the development of fuel cells using organic superacids as the electrolyte. The bulk of the studies to date are with aqueous trifluoromethanesulfonic acid. Electrode kinetics of the oxygen reduction action are sufficiently enhanced in the superacids as compared with phosphoric acid. The noble metal content of the electrodes can be minimized and perhaps eliminated in fuel cells with such electrolytes. DOE

N81-21573# Los Alamos Scientific Lab., N. Mex.
HEAT-FLOW MEASUREMENTS IN THE STATE OF ARKANSAS Final Report
R. F. Roy, Bruce Taylor, Arthur J. Pyron, and James C. Maxwell Oct. 1980 16 p refs
(Contract W-7405-eng-36)
(LA-8569-MS) Avail: NTIS HC A02/MF A01

The pertinent holes are located in the four major geological divisions of the state. Despite the presence of hot springs in the Ouachita region, these figures are not especially encouraging as indicators of the a possible geothermal resource, and the low heat-flow in the syenite intrusion at Little Rock is certainly disappointing in terms of hot dry rock exploitation. The most promising area geothermally is in the southern counties (in the Gulf coastal plain), where a compilation of geothermal gradient estimates, made from published well-temperature data, shows a trend towards higher than average gradients. DOE

N81-21574# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
PHOTOVOLTAIC CONCENTRATOR ARRAY PRODUCTION PROCESS STUDY. VOLUME 2: STUDY RESULTS Final Report, 25 Jan. 1979 - 24 Jan. 1980
R. C. Hodge Jan. 1981 198 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7055/2) Avail: NTIS HC A09/MF A01

Photovoltaic concentrator array designs were evaluated in terms of their low production and life cycle cost analysis. Salient program design guidelines were defined which established the basic performance assumptions, environmental issues and design trade-off variables. Available design detail was then compiled. Preliminary manufacturing costs were estimated for each of the array concepts. Using energy costs, and assessments as to each array's technology readiness and improvement potential, the various arrays were ranked. The most promising arrays selected for the more detailed design optimization and cost studies were the point focus Fresnels, linear Fresnels, and one-axis troughs. DOE

N81-21575# General Electric Co., Philadelphia, Pa. Space Div.
DESIGN OF A SIDE-BY-SIDE PHOTOVOLTAIC THERMAL SYSTEM FOR A NORTHEAST ALL-ELECTRIC RESIDENCE
E. M. Mehalick, G. OBrien, G. F. Tully, J. Johnson, J. Parker, N. Truncellito, and R. Felice Nov. 1980 204 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7148) Avail: NTIS HC A10/MF A01

There are three major system elements: the photovoltaic array, the electric power conversion subsystem, and the thermal subsystem. A key to the sizing of the PV and thermal array is the relative cost of each system. Therefore, the ratio of the costs associated with each system was varied parametrically to define ultimate sizing of the PV and thermal array. In general, the results indicate larger PV array area and minimal thermal array area for the set of cost assumptions described. DOE

N81-21576# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR ENERGY IN ITALY: A PROFILE OF RENEWABLE ENERGY ACTIVITY IN ITS NATIONAL CONTEXT
Carol A. Shea Dec. 1980 76 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/SP-763-718) Avail: NTIS HC A05/MF A01

The energy profile includes: imported energy sources; solar research and development; solar energy organizations; solar energy related legislation and administration policies; and international agreements, contacts, manufacturers, and projects. The country

overview includes: Italian Republic geopolitical analysis; economic analysis; and cultural aspects. T.M.

N81-21577# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

INTERIM PERFORMANCE CRITERIA FOR PHOTOVOLTAIC ENERGY SYSTEMS

Richard DeBlasio, Steven Forman (MIT/Lincoln Lab.), Steve Hogan, Gary Nuss, Hal Post (Sandia National Labs.), Ronald Ross (JPL), and Harry Schafft (NBS) Dec. 1980 230 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-742-654) Avail: NTIS HC A11/MF A01

The performance criteria address characteristics of present-day photovoltaic systems that are of interest to manufacturers, government agencies, purchasers, and all others interested in various aspects of photovoltaic system performance and safety. The performance criteria apply to the system as a whole and to its possible subsystems: array, power conditioning, monitor and control, storage, cabling, and power distribution. They are further categorized according to the following performance attributes: electrical, thermal, mechanical/structural, safety durability/reliability, installation/operation/maintenance, and building/site. DOE

N81-21578# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

WIND ENERGY SYSTEMS INFORMATION USER STUDY

W. W. Belew, B. L. Wood, T. L. Marle, and C. L. Reinhardt Jan. 1981 278 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-751-749) Avail: NTIS HC A13/MF A01

The results of a series of telephone interviews with potential users of information on wind energy conversion are described. These interviews, part of a larger study covering nine different solar technologies, attempted to identify: the type of information each distinctive group of information users needed, and the best way of getting information to that group. Groups studied include: wind energy conversion system researchers; wind energy conversion system manufacturer representatives; wind energy conversion system distributors; wind turbine engineers; utility representatives; educators; county agents and extension service agents; and wind turbine owners. DOE

N81-21579# Midwest Research Inst., Golden, Colo.

YEARLY AVERAGE PERFORMANCE OF THE PRINCIPAL SOLAR COLLECTOR TAPES

Ari Rabl Jan. 1981 56 p refs

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-631-716) Avail: NTIS HC A04/MF A01

The results of hour by hour simulations for 26 meteorological stations were used to derive universal correlations for the yearly total energy that can be delivered by the principal solar collector types; flat plate, evacuated tubes, CPC, single and dual axis tracking collectors, and central receiver. The correlations are first and second order polynomials in yearly average insolation, latitude, and threshold (= heat loss/optical efficiency). With these correlations, the yearly collectible energy can be found by multiplying the coordinates of a single graph by the collector parameters, which reproduces the results of hour by hour simulations with an accuracy (rms error) of 2% for flat plates and 2% to 4% for concentrators. DOE

N81-21580# Department of Energy, Washington, D. C. Assistant Secretary for Conservation and Solar Energy.

ALTERNATE SOURCES OF ENERGY

1980 155 p Presented at the Alternate Sources of Energy Conf., New York, 29 Sep. 1980

(CONF-8009109) Avail: NTIS HC A08/MF A01

Eleven papers are included. A separate abstract was prepared for each for Energy Research Abstracts (ERA); seven were selected for Energy Abstracts for Policy Analysis. DOE

N81-21581# Advanced Mechanical Technology, Inc., Newton, Mass.

DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER GENERATION APPLICATIONS IN THE 500 TO 3000 HORSEPOWER RANGE, VOLUME 1

Mark Schuetz, Joseph Gerstmann, Lawrence Hoagland, Walter Syniuta, Rolf Krisher, and Cyril Randall 15 Sep. 1980 294 p refs

(Contract DE-AC02-79ET-15207)

(DOE/ET-15207/T2-Vol-1) Avail: NTIS HC A13/MF A01

The conceptual design and associated cost estimates of a stationary Stirling engine capable of being fueled by a variety of heat sources are discussed with emphasis on coal firing. The development and evaluation of conceptual designs are separated into two broad categories: the A designs which represent the present state-of-the-art and which are demonstrable by 1985 with minimum technical risk; and the B designs which involve advanced technology and therefore would require significant research and development prior to demonstration and commercialization, but which may ultimately offer advantages in terms of lower cost, better performance, or higher reliability. DOE

N81-21582# Aerojet Energy Conservation Co., Sacramento, Calif.

IMPROVED LIQUID/SOLIDS HANDLING MODULE Final Report, 1 Sep. 1979 - 31 Oct. 1980

L. K. West 1980 65 p refs

(Contract DE-AC03-79ET-27193)

(DOE/ET-27193/T1; FR-2321:01) Avail: NTIS HC A04/MF A01

A Mobile Liquid/Solids handling (L/S) unit was constructed that is the active element for a low cost Advanced Primary Geothermal Heat Exchanger (APEX), presently under development. The L/S system incorporates two alternating hydrocyclone-accumulator tank combinations and an injection pump. Sand particles are injected into the main flow and then separated and recirculated at capture efficiencies of greater than 99%. The system was tested at varying flowrates, solids concentrations, and particle sizes to determine an optimum operating point.DOE

N81-21583# Ames Lab., Iowa.

PHOTOELECTROCHEMICAL SOLAR CELLS BASED ON d-BAND ELECTROCHEMISTRY AT TRANSITION METAL DISELENIDES Final Technical Progress Report

Bruce A. Parkinson Oct. 1980 35 p refs

(Contracts W-7405-eng-82; EG-77-C-91-4042)

(IS-4759) Avail: NTIS HC A03/MF A01

The work with tungsten diselenide and molybdenum diselenide can be divided into two major directions. The first direction is the growth of high quality single crystals of the materials to establish the practical maximum solar energy conversion efficiency of layered compounds. The second effort utilizes less perfect single crystals with edge sites exposed as models of a polycrystalline device with the goal of understanding the mechanism by which recombination limits the efficiency of these materials and to devise methods for reducing the recombination. Progress is reported. DOE

N81-21584# Advanced Mechanical Technology, Inc., Newton, Mass.

DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER GENERATION APPLICATIONS IN THE 500 TO 3000 HORSEPOWER RANGE. VOLUME 2: PROGRAM PLAN

Mark Schuetz, Joseph Gerstmann, and Lawrence Hoagland 15 Sep. 1980 56 p

(Contract DE-AC02-79ET-15207)

(DOE/ET-15207/T2-Vol-2) Avail: NTIS HC A04/MF A01

A plan for implementing the proposed state-of-the-art design was developed. The main objective of the project is to demonstrate a large coal-fired Stirling engine and thus shorten the lead time to commercialization. The program plan is based on the U-4 engine concept fired by a fluidized bed combustor with a two-stage gravity-assisted heat pipe. DOE

N81-21585# Denver Univ., Colo. Denver Research Inst.

MUNICIPAL GEOTHERMAL HEAT UTILIZATION PLAN FOR GLENWOOD SPRINGS, COLORADO Final Technical Report

31 Dec. 1980 276 p refs

(Contract DE-AS07-79ID-12049)

(DOE/ID-12049-3) Avail: NTIS HC A13/MF A01

The results show that the use of geothermal heat is indeed feasible when compared to the cost of natural gas. The proposed system is composed of a wellhead plate heat exchanger which

feeds a closed distribution loop of treated water circulated to the buildings which form the load. The base case system was designed to supply twice the demand created by the seven public buildings in order to take advantage of some economies of scale. To increase the utilization factor of the available geothermal energy, a peaking boiler which burns natural gas is recommended. Disposal of the cooled brine would be via underground injection. DOE

N81-21586# EIC, Inc., Newton, Mass.
LOW TEMPERATURE ALKALI METAL-SULFUR BATTERIES Final Report, 1 Dec. 1974 - 30 Nov. 1978
S. B. Brummer, R. D. Rauh, K. M. Abraham, F. W. Dampier, V. Subrahmanyam, G. F. Pearson, J. K. Surprenant, and J. M. Buzby Mar. 1980 128 p refs
(Contracts DE-AC02-76ET-25003; EY-76-C-02-2520)
(COO-2520-7) Avail: NTIS HC A07/MF A01

Work on the development of rechargeable, ambient-temperature Li sulfur and Li metal sulfide batteries is reported. The Li-S system has the cathode material dissolved in the electrolyte, as Li2S sub n. Tetrahydrofuran, 1M LiAsF6, is one of the more attractive electrolytes discovered for this cell, since it can dissolve up to approx. 10M S as Li2Sn. Despite the oxidative nature of the electrolyte, Li is stable in it and can be electrodeposited from it on battery charge. DOE

N81-21587# General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
GUIDELINES FOR CONCEPTUAL DESIGN AND EVALUATION OF AQUIFER THERMAL ENERGY STORAGE
C. F. Meyer and W. Hauz Columbus, Ohio Battelle Memorial Inst. Oct. 1980 249 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3581) Avail: NTIS HC A11/MF A01

Guidelines are presented for use as a tool by those considering application of aquifer thermal energy storage (ATES) technology. The guidelines assist utilities, municipalities, industries, and other entities in the conceptual design and evaluation of systems employing ATES. The potential benefits of ATES are described, an overview is presented of the technology and its applications, and rules of thumb are provided for quickly judging whether a proposed project has sufficient promise to warrant detailed conceptual design and evaluation. The characteristics of sources and end uses of heat and chill which are seasonally mismatched and may benefit from ATES are discussed. Storage and transport subsystems and their expected performance and cost are described. A methodology is presented for conceptual design of an ATES system and evaluation of its technical and economic feasibility in terms of energy conservation, cost savings, fuel substitution, improved dependability of supply, and abatement of pollution. DOE

N81-21588# Hanford Engineering Development Lab., Richland, Wash.
DEVELOPMENT STATUS OF THE ELECTRO-THERMAL AND SPATIAL SPECTRAL SCANNING SYSTEM FOR SOLAR CELLS
D. R. Green, L. C. Olsen, L. S. Price, and E. M. Sheen Dec. 1980 20 p refs
(Contract DE-AC14-76FF-02170)
(HEDL-TC-1879) Avail: NTIS HC A02/MF A01

Electro-thermal infrared scanning is a method for detecting local differences in diode parameters. This method uses an infrared scanner to map small increases in local surface temperatures of a diode after applying a bias voltage. The feasibility of this method was demonstrated for diodes reverse biased beyond the breakdown voltage. The spatial spectral scanner scans the solar cell with a minute spot of variable frequency light while the cell's output current is recorded, and augments information from the electro-thermal system. DOE

N81-21589# Martin Marietta Aerospace, Denver, Colo. Denver Operations Div.
SOLCOST, VERSION 3.0. SOLAR ENERGY DESIGN PROGRAM FOR NON-THERMAL SPECIALISTS
May 1980 281 p
(Contract DE-AC02-76ET-20108)
(DOE/ET-20108/T2) Avail: NTIS HC A13/MF A01

The program is a public domain computerized design tool intended to size solar systems with a methodology based on life cycle cost. An overview of SOLCOST capabilities and options is presented. A detailed guide to the SOLCOST input parameters is included. Sample problems showing typical input decks and resulting SOLCOST output sheets are given. DOE

N81-21590*# PRC Energy Analysis Co., Los Angeles, Calif.
SATELLITE POWER SYSTEM (SPS) SOCIETAL ASSESSMENT
Dec. 1980 57 p refs Sponsored by NASA
(Contract DE-AC01-79ER-10041)
(NASA-CR-164153; DOE/ER-10041/T12) Avail: NTIS HC A04/MF A01 CSCL 10A

Construction and operation of a 60-unit (300 GW) domestic SPS over the period 2000 to 2030 would stress many segments of U.S. society. A significant commitment of resources (land, energy, materials) would be required, and a substantial proportion of them would have to be committed prior to the production of any SPS electricity. Forty-four concerns about the SPS were identified via a public outreach experiment involving 9000 individuals from three special interest organizations. The concerns focused on environmental impacts (particularly the effects of microwave radiation) and the centralizing tendency of the SPS on society. DOE

N81-21591# RCA Labs., Princeton, N. J.
AMORPHOUS THIN FILMS FOR SOLAR-CELL APPLICATIONS Final Report, 11 Sep. 1979 - 10 Sep. 1980
D. E. Carlson, R. S. Crandall, J. Dresner, B. Goldstein, J. J. Hanak, A. R. Moore, H. E. Schade, D. L. Staebler, and H. A. Weakliem Oct. 1980 92 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-0-8254-F) Avail: NTIS HC A05/MF A01

The drift mobility was measured in doped amorphous silicon by measuring the current transient in a Schottky-barrier device during a reverse bias voltage pulse. Mass spectroscopy studies indicate that the film growth cannot be a simple ion surface recombination process but is probably due to either thermal decomposition of higher silanes or free radical surface reaction. The photoelectromagnetic effect was used to measure the hole diffusion length in undoped a-Si:H. DOE

N81-21592# Rosenblatt (M.) and Son, Inc., New York.
PRELIMINARY DESIGNS FOR MODULAR OTEC PLATFORMS' STATION-KEEPING SUBSYSTEMS, VOLUME 3 Final Report
29 Feb. 1980 176 p refs
(Contracts DE-AI01-77ET-20396; EG-77-A-29-1078)
(DOE/NOAA/OTEC-30-Vol-3; MRS-Rept-804206) Avail: NTIS HC A09/MF A01

The basic design assumptions, the technical approach followed, and the results of design iterations, reliability and performance analyses are given. The summary cost estimates for each of the alternative SKSS concepts considered are given, and a time schedule for the recommended concept is provided. The effects of varying some of the important parameters used in SKSS design on the performance and cost of the mooring system are investigated and results presented. The tests required and other developmental recommendations in order to vertify and confirm the basic design assumptions are discussed. DOE

N81-21593# Bonneville Power Administration, Portland, Oreg. Div. of Power Resources.
WIND ENERGY INTEGRATION STUDY
Aug. 1980 77 p
(Contract DE-AC79-79BP-10552)
(DOE/BP-10552/17) Avail: NTIS HC A05/MF A01

The feasibility of integrating a simulated 3000 megawatt (MW) wind energy conversion network into the Pacific Northwest hydro-thermal generation system was investigated. The following areas were identified for preliminary analysis: seasonal power planning (regulation); secondary energy (surplus); energy reserve planning; peak reserves; and hourly planning. DOE

N81-21594# Institutet foer Vatten-Och Luftvaardsforskning, Fryksta (Sweden).
LAKES AS A HEAT SOURCE FOR RESIDENTIAL HEATING.

A SURVEY OF COSTS IN COMPARISON WITH DIFFERENT SYSTEMS AND ECOLOGICAL CONSEQUENCES
Thomas Hellstroem 1980 31 p refs In SWEDISH
(IVL-B-557) Avail: NTIS (US sales only)HC A03/MF A01

The low grade energy in lakes and ground water can be used for residential heating by using heatpumps. An economic comparison of different systems was performed. It was assumed that the temperature of the produced hot water would be 60 C, and that the capacity would be 6500 MWh per year. The production costs were calculated but not the distribution costs. The ecologic consequences are discussed. It was shown that production of energy from free water will give the lowest energy costs. In special cases groundwater would give the same price. Storage of hot water is not profitable. The ecologic effects will be quite small but there will be a decrease in biological productivity. A lake as heat source for residential heating would be economically competitive with oil. DOE

N81-21595# Alaska State Div. of Energy and Power Development, Anchorage.
ALASKA REGIONAL ENERGY RESOURCES PLANNING PROJECT. PHASE 2: COAL, HYDROELECTRONIC AND ENERGY ALTERNATIVES. VOLUME 1: BELUGA COAL DISTRICT ANALYSIS
Gene Rutledge, Darlene Lane, and Greg Edblom 1980 452 p refs 3 Vol.
(Contract DE-AT06-77EV-73002)
(DOE/EV-73002/1-Vol-1; DEPD-81-001-1-Vol-1) Avail: NTIS HC A20/MF A01

Socio-economic implications of the development and management alternatives are discussed. A review of permits and approvals necessary for the initial development of Beluga Coal Field is presented. Major land tenure issues in the Beluga Coal District as well as existing transportation routes and proposed routes and sites are discussed. The various coal technologies which might be employed at Beluga are described. Transportation options and associated costs of transporting coal from the mine site area to a connecting point with a major, longer distance transportation mode and of transporting coal both within and outside (exportation) the state are discussed. DOE

N81-21596# Alaska State Div. of Energy and Power Development, Anchorage.
ALASKA REGIONAL ENERGY RESOURCES PLANNING PROJECT. PHASE 2: COAL, HYDROELECTRONIC AND ENERGY ALTERNATIVES. VOLUME 2: HYDROELECTRIC DEVELOPMENT
Gene Rutledge, Darlene Lane, and Greg Edblom 1980 177 p refs
(DOE/EV-73002/1-Vol-2; DEPD-81-001-2-Vol-2) Avail: NTIS HC A09/MF A01

More than 600 sites for possible hydroelectric power development were identified in Alaska. The power potential of these sites is 200 times as great as the currently developed hydroelectric capacity of 131 MW. Information is presented on the location and characteristics of Alaska's hydropower sites, licensing and cost requirements for site development, the environmental impact of hydroelectric development, and a review of hydroelectric technology including low head, ocean wave, and tidal hydropower and the equipment for hydropower conversion. DOE

N81-21597# Alaska State Div. of Energy and Power Development, Anchorage.
ALASKA REGIONAL ENERGY RESOURCES PLANNING PROJECT. PHASE 2: COAL, HYDROELECTRIC AND ENERGY ALTERNATIVES. VOLUME 3: ALASKA'S ALTERNATIVE ENERGIES AND REGIONAL ASSESSMENT INVENTORY UPDATE
Gene Rutledge, Darlene Lane, and Greg Edblom 1980 300 p refs
(Contract DE-AT06-77EV-73002)
(DOE/EV-73002/1-Vol-3; DEPD-81-001-3-Vol-3) Avail: NTIS HC A13/MF A01

Topics include the utilization of windpower and geothermal resources, the utilization of very small hydropower systems, and the use of fuel cells. Waste energy utilization is also discussed and emphasis is placed on the use of wood residues and waste heat for energy conversion. Siting criteria for each of the alternate energy systems is presented. T.M.

N81-21598# SRI International Corp., Menlo Park, Calif.
LINE-FOCUS SOLAR CENTRAL POWER SYSTEM, PHASE 1. VOLUME 1: EXECUTIVE SUMMARY Final Report, 29 Sep. 1978 - 30 Apr. 1980
Arthur J. Slemmons Apr. 1980 51 p ref 3 Vol.
(Contracts DE-AT03-76ET-20550; EY-76-C-03-0115)
(DOE/ET-20550/2-Vol-1) Avail: NTIS HC A04/MF A01

The SRI International industrial team completed a subsystem and system parametric analysis, a 100 MW sub e commercial plant conceptual design, and a cost and performance analysis. A commercial assessment was made of the system. DOE

N81-21599# SRI International Corp., Menlo Park, Calif.
LINE-FOCUS SOLAR CENTRAL POWER SYSTEM, PHASE 1. VOLUME 2: TEXT Final Report, 29 Sep. 1978 - 30 Apr. 1980
Arthur J. Slemmons Apr. 1980 414 p refs 3 Vol.
(Contracts DE-AT03-76ET-20550; EY-76-C-03-0115)
(DOE/ET-20550/2-Vol-2) Avail: NTIS HC A18/MF A01

The conceptual design, parametric analysis, cost and performance analysis, and a commercial assessment of a 100 MWe high temperature line focus central power system are presented. Parametric analyses and conceptual design of the heliostat subsystem, receiver subsystem, heat transport subsystem, energy storage subsystem, electrical power generating subsystem and master control subsystem are included. A market analysis and development plan are given. DOE

N81-21600# SRI International Corp., Menlo Park, Calif.
LINE-FOCUS SOLAR CENTRAL POWER SYSTEM, PHASE 1. VOLUME 3: APPENDICES Final Report, 29 Sep. 1978 - 30 Apr. 1980
Arthur J. Slemmons Apr. 1980 75 p refs 3 Vol.
(Contracts DE-AT03-76ET-20550; EY-76-C-03-0115)
(DOE/ET-20550/2-Vol-3) Avail: NTIS HC A04/MF A01

Methods of determination of molten salt heat-transfer coefficients and tube-wall temperatures are discussed. Inputs for STEAEC programs, description of system analysis computer program, receiver analysis program, and heliostat production plan and design methodology are described. DOE

N81-21601# Spectrolab, Inc., Sylmar, Calif.
THE 10 KILOWATT PHOTOVOLTAIC CONCENTRATOR SYSTEM AS INSTALLED AT SANDIA LABORATORIES, 1979 Final Technical Progress Report
K. Ronney Dec. 1980 87 p
(Contract DE-AC04-76DP-00789)
(SAND-80-7063) Avail: NTIS HC A05/MF A01

The photovoltaic concentrator system is described. Included are system description, problems encountered and resolved during fabrication, and system performance analysis. DOE

N81-21602# University of Southern Illinois, Carbondale.
LONGTERM SOLAR HEAT STORAGE IN AN UNDERGROUND WATER CISTERN RETROFITTED WITH THERMAL INSULATION Progress Report
W. L. Borst 30 Oct. 1980 3 p refs
(Contract DE-FG02-79R5-10106)
(DOE/R5-10106/2; TPR-2) Avail: NTIS HC A02/MF A01

The performance of the cistern was tested by measuring storage and surrounding soil temperatures over extended periods of time as heat was added from a solar collector (summer, fall, and winter) or environmental coolness was added (via cold air blown into the cistern) in winter. From these measurements, storage time-constants of the order of 6 months were inferred and verified. DOE

N81-21603# Stanford Univ., Calif.
SOLAR SPACE AND WATER HEATING SYSTEM AT STANFORD UNIVERSITY, CENTRAL FOOD SERVICES BUILDING Final Report
May 1980 143 p
(Contract DE-AB03-77CS-31522)
(DOE/CS-31522/T1) Avail: NTIS HC A07/MF A01

This active hydronic domestic hot water and space heating

system was 840 sq ft of single-glazed, liquid, flat plate collectors and 1550 gal heat storage tanks. The following are discussed: energy conservation, design philosophy, operation, acceptance testing, performance data, collector selection, bidding, costs, economics, problems, and recommendations. An operation and maintenance manual and as-built drawings are included in appendices. DOE

N81-21604# Battelle Pacific Northwest Labs., Richland, Wash.
INVESTIGATIONS ON CATALYZED STEAM GASIFICATION OF BIOMASS. APPENDIX B: FEASIBILITY STUDY OF METHANOL PRODUCTION VIA CATALYTIC GASIFICATION OF 2000 TONS OF WOOD PER DAY
L. K. Mudge, S. L. Weber, D. H. Mitchell, L. J. Sealock, Jr., R. J. Robertus, and Davy McKee Jan. 1981 124 p
(Contract DE-AC06-76RL-01830)
(PNL-3695-App-B) Avail: NTIS HC A06/MF A01

The plant design in this study was developed from information on gasifier operation supplied by the Pacific Northwest Laboratory (PNL), operated by Battelle. PNL obtained this information from laboratory and process development unit testing. The plant is designed to process 2000 tons per day of dry wood to methanol. Plant production is 997 tons per day of methanol with a HHV of 9784 Btu per pound. All process and support facilities necessary to convert wood to methanol are included in this study. DOE

N81-21605# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF GENERIC SOLAR THERMAL SYSTEMS FOR LARGE POWER APPLICATIONS: ANALYSIS OF ELECTRIC POWER GENERATING COSTS FOR SYSTEMS LARGER THAN 10 MWe, VOLUME 1
W. J. Apley, S. P. Bird, D. R. Brown, M. K. Drost, J. A. Fort, B. A. Garrett-Price, W. P. Patton, and T. A. Williams Nov. 1980 200 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3533-Vol-1) Avail: NTIS HC A09/MF A01

Seven generic types of collectors, together with associated subsystems for electric power generation, were considered. The collectors can be classified into three categories: two-axis tracking (with compound-curvature reflecting surfaces); one-axis tracking (with single-curvature reflecting surfaces); and nontracking (with low-concentration reflecting surfaces). All seven collectors were analyzed in conceptual system configurations with Rankine-cycle engines. In addition, two of the collectors were analyzed with Brayton-cycle engines, and one was analyzed with a Stirling-cycle engine. With these engine options, and the consideration of both thermal and electrical storage for the Brayton-cycle central receiver, 11 systems were formulated for analysis. DOE

N81-21606# Oak Ridge National Lab., Tenn. Engineering Technology Div.
FUEL CYCLE ANALYSIS FOR FOSSIL ENERGY SYSTEMS: COAL COMBUSTION
W. L. Greenstreet and R. L. Carmichael Feb. 1981 392 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL-5661) Avail: NTIS HC A17/MF A01

Elements of the fuel cycle for coal combustion in power generation are examined; and information on economics, technological status, energy efficiencies, and environmental issues is reviewed. Overall background information is provided for guidance in identifying issues and establishing needs and priorities for engineering research, development, and demonstration. The elements treated include mining, transportation, coal preparation, direct combustion, and environmental control technology. The treatment used differs from that of usual compendiums in its emphasis on integrated examination and presentation directed primarily toward providing bases for general assessment and for guidance in program development. Emphasis is on program identification as opposed to advocacy. DOE

N81-21607# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CONSTRUCTION OF A PHOTOVOLTAIC POWER SYSTEM AT NATURAL BRIDGES NATIONAL MONUMENT
A. E. Benoit Dec. 1980 25 p
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/94) Avail: NTIS HC A02/MF A01

A 100 kW peak photovoltaic (PV) power system at Natural Bridges National Monument in Utah is described. This system is the largest of its kind in the world. The construction phases of the program are described, and a chronological history of the events and problems encountered when such a large and complex task is undertaken in a remote area with very limited fabrication facilities is given. This experiment demonstrates the application of solar energy to the variety of loads found in a small and remote community. This solar energy system was designed to meet all electrical requirements when there is no utility grid, with only occasional back-up from an existing diesel generator. DOE

N81-21608# Massachusetts Inst. of Tech., Cambridge.
CHALCOGENIDE-GLASS SOLAR CELLS Final Technical Progress Report, 6 Apr. 1979 - 31 Oct. 1980
D. Adler and John S. Haggerty 1980 66 p
(Contract DE-AC03-79ET-23043)
(DOE/ET-23043/T1) Avail: NTIS HC A04/MF A01

A wide array of glasses in the Se-Te-As system were prepared by RF-sputtering in either Ar or Ar/H2 atmospheres and characterized optically and electrically. Some films were co-sputtered with small concentrations of Li, Na, or K. Glasses with optical gaps of 1.2 to 1.5 eV were investigated in solar-cell configurations. The Se-Te glasses without As exhibited transient behavior, the time-varying effects persisting for the order of several minutes or more. These transients were explained by invoking the unique properties of the valence alternation pairs (VAPs) which must exist in such glasses in large densities. Small concentrations (1 to 5%) of As effectively suppressed the transient effects. DOE

N81-21609# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MEASURING DIRT ON PHOTOVOLTAIC MODULES, PART 2
E. B. Murphy Nov. 1980 20 p refs
(Contract DE-AC02-76ET-20279)
(COO-4094-86-Pt-2) Avail: NTIS HC A02/MF A01

Two techniques for measuring and quantifying surface dirt and its effects on module output are described. One technique, using a standard portable glossmeter, measures the scattering of specular light by surface-dirt particles. This measured value can then be correlated with the peak power performance before and after cleaning. A second technique is also described which enables an investigator, in the field, to take dirt samples or replicas of the accumulated surface dirt from the PV module. Photomicrographs of urban, suburban, and rural dirt particles are shown. Measurements of module peak power before and after cleaning indicate that dirt particles in urban environments are more degrading to PV performance than dirt particles found in rural areas. DOE

N81-21610# Department of Energy, Washington, D. C. Energy Information Administration.
PERFORMANCE PROFILES OF MAJOR ENERGY PRODUCERS
Dec. 1980 111 p refs
(DOE/EIA-0206/78) Avail: NTIS HC A06/MF A01

Data for 26 major energy producing companies (coal, oil, gas, nuclear) for 1977 and 1978 are presented. Data were collected using the Financial Reporting System (FRS) reporting Form EIA-28 which collects disaggregated financial data on revenues and expenses, assets and liabilities, and sources and uses of funds. The overall corporate financial performance of 26 FRS companies are compared with the other major industrial companies. Differences in relative commitment and profitability associated with alternative lines of corporate activity are examined. The size composition and international character of FRS companies are examined. Oil and gas resource development efforts in 1978 are traced. Data on resource development expenditures are complemented by information on reserve holdings, changes in reserves, and characteristics of exploration and development efforts. Foreign activity is compared with domestic. DOE

N81-21611# Los Alamos Scientific Lab., N. Mex.
CERAMIC HEAT PIPE DEVELOPMENT Annual Report, 1 Oct. 1979 - 30 Sep. 1980
M. Merrigan Dec. 1980 30 p refs
(Contract W-7405-eng-36)

(DOE/TIC-11389) Avail: NTIS HC A03/MF A01

Progress in developing ceramic heat pipe recuperators for recovering heat from industrial processing furnaces is reported. Information is included on the design, materials procurement, fabrication, materials testing, performance testing, performance and cost of ceramic heat pipes, especially tungsten-coated silicon carbide and Sic-W-Mo heat pipes. DOE

N81-21612# Argonne National Lab., Ill.

STARFIRE: A COMMERCIAL TOKAMAK FUSION POWER PLANT STUDY, VOLUME 2

Sep. 1980 863 p refs Prepared in cooperation with McDonnell Douglas Astronautics Co., St. Louis, General Atomic Co., and Parsons (Ralph M.) Co., Los Angeles

(Contract W-31-109-eng-38)

(ANL/FPP-80-1-Vol-2) Avail: NTIS HC A99/MF A01

The construction of the plant and the balance of the plant design are discussed. Radioactivity, heat transport and energy conversion; tritium systems, cryogenics, and instrumentation and control equipment are also discussed. The maintenance and operation of the plant are described. T.M.

N81-21613# California Univ., Berkeley. Lawrence Berkeley Lab.

ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM CONCEPT DEVELOPMENT AND EVALUATION PROGRAM: NONMICROWAVE HEALTH AND ECOLOGICAL EFFECTS

Margaret R. White Nov. 1980 89 p refs

(Contract W-7405-eng-48)

(DOE/ER-0089) Avail: NTIS HC A05/MF A01

A preliminary reference system was developed. The assessment is summarized as to scope, methodology, impacts of terrestrial development, launch and recovery of spacecraft, space activities (including health effects of the space environment, ionizing radiation, electromagnetic exposure, spacecraft charging and environmental interactions, occupational hazards, etc.) and construction and operation of rectenna (ground receiving station). DOE

N81-21614# Argonne National Lab., Ill.

COMPARATIVE HEALTH AND SAFETY ASSESSMENT OF THE SATELLITE POWER SYSTEM AND OTHER ELECTRICAL GENERATION ALTERNATIVES

Dec. 1980 147 p refs

(Contract W-31-103-eng-38)

(DOE/ER-0091) Avail: NTIS HC A07/MF A01

An analysis is presented of existing data on the health and safety risks of a satellite power system and six electrical generation systems. The systems are compared on the basis of expected deaths and person-days lost per year associated with 1000 MW of average electricity generation. Risks are estimated and uncertainties indicated for all phases of the energy production cycle, including fuel and raw material extraction and processing, direct and indirect component manufacture, on-site construction, and system operation and maintenance. Also discussed is the potential significance of related major health and safety issues that remain largely unquantifiable. The appendices provide more detailed information on risks, uncertainties, additional research needed, and references for the identified impacts of each system. DOE

N81-21615# California Univ., Livermore. Lawrence Livermore Lab.

SYNOPSES OF R AND D IN GEOTHERMAL-GEOCHEMICAL ENGINEERING AT THE LAWRENCE LIVERMORE NATIONAL LABORATORY, 1976 - 1980

J. E. Harrar, comp. Dec. 1980 23 p refs

(Contract W-7405-eng-48)

(UCID-18863) Avail: NTIS HC A02/MF A01

Research is summarized on: geothermal field test apparatus; brine acidification as a means of scale control at the Salton Sea Geothermal Field; tests of seeding and other chemical methods for the control of scale at the Salton Sea Geothermal Field; tests of proprietary organic additives for the control of scale at the Salton Sea Geothermal Field; tests of generic organic compounds for control of scale at Salton Sea Geothermal Field; studies of the dissolution of geothermal scale; chemical measurement developments; chemical modeling of geothermal systems; processing of geothermal brine effluents for injection; hydrogen sulfide abatement using geothermal brine effluents; use of surface waters to supplement injection at the Salton Sea Geothermal Field; and measurement of injectability of geothermal brines. DOE

N81-21616# Los Alamos Scientific Lab., N. Mex. Systems Analysis and Assessment Div.

MICRO-LEVEL LAND USE IMPACTS OF BIOCONVERSION M.S. Thesis

Virginia Kay Barber Parsons Nov. 1980 94 p refs

(Contract W-7405-eng-36)

(LA-8599-T) Avail: NTIS HC A05/MF A01

Implementation of the land intensive bioenergy technologies involves actions that impact existing land use at the local level. Due to the differences in crop type, yield per acre, existing land use conditions, and agricultural practices throughout the U.S., microlevel information is necessary. The local biomass potential is examined based on existing land use in seven countries in different agricultural regions throughout the U.S. These case studies serve as a basis for identifying the microlevel land use impacts of the bioconversion technologies. DOE

N81-21617# Sandia Labs., Livermore, Calif. Energy Systems Studies Div.

METHODOLOGY FOR ESTIMATING FUTURE MARKET VALUES OF SOLAR THERMAL TECHNOLOGIES

Larry D. Brandt Dec. 1980 24 p refs Sponsored by DOE

(SAND-80-8248) Avail: NTIS HC A02/MF A01

Projections of the future market value of solar systems are needed to derive cost goals for the emerging solar thermal technologies. The research documented has developed a methodology for projecting market values based on economic parity with the estimated future costs of conventional (fossil-fueled) technologies. Representative solar system values are presented for exemplary sets of economic assumptions including those under consideration by the Solar Thermal Cost Goals Committee. The effects on market value of variations in the rates of return required by potential users and the costs of alternative fuels are illustrated. DOE

N81-21618# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

CURRENT AND FUTURE INDUSTRIAL ENERGY SERVICE CHARACTERIZATIONS, VOLUME 1

Frank Krawiec, Tom Thomas, Frederick Jackson, Dilip R. Limaye, Steve Isser, Ken Karnofsky, and Todd D. Davis Oct. 1980 243 p refs Prepared in cooperation with Synergetic Resources Corp.

(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)

(SERI/TR-733-790-Vol-1) Avail: NTIS HC A11/MF A01

Current and future energy demands, end uses, and cost used to characterize typical applications and resultant services in the industrial sector of the United States are examined. A review and evaluation of existing industrial energy data bases was undertaken to assess their potential for supporting SERI research on: (1) market suitability analysis; (2) market development; (3) end use matching; (4) industrial applications case studies; and (5) identification of cost and performance goals for solar systems and typical information requirements for industrial energy end use. The focus was on fuels and electric energy used for heat and power purchased by the manufacturing subsector and listed by 2, 3, and 4 digit SIC, primary fuel, and end use. The effects of federal and state industrial energy conservation programs on future industrial sector demands were assessed. DOE

N81-21619# Commerce Dept., Washington, D.C.

PHOTOVOLTAICS INDUSTRY PROFILE

Oct. 1980 34 p

(Contract DE-AC06-76RL-01830)

(DOE/RL-01830/T3) Avail: NTIS HC A03/MF A01

A description of the status of the U.S. photovoltaics industry is given. Principal end user industries are identified, domestic and foreign market trends are discussed, and industry organized and U.S. government organized trade promotion events are listed.

Trade associations and trade journals are listed, and a photovoltaic product manufacturers list is included. DOE

N81-21620# Sandia Labs., Albuquerque, N. Mex. Aerothermodynamics Div.

A PRELIMINARY STUDY OF POWER GENERATION FROM VERTICAL-AXIS TURBINES IN THE GULF STREAM

Mina L. Carnicom and Robert E. Sheldahl Jan. 1981 42 p refs

(Contract DE-AC04-76DP-00790)

(SAND-80-0102) Avail: NTIS HC A03/MF A01

A system consisting of paired, vertical axis turbines suspended from a tethered, buoyant, submerged platform that contains the generator is proposed as a method for power generation from the Gulf Stream. Drilled piles are the most likely kind of mooring system for the holding capacity needed. Successful extraction of electrical energy from the Gulf Stream requires consideration of the environment, as well as its effects on potential materials and surface features of the power generating system. Because of its topography, the region called the Straits of Florida contains the fastest flowing water masses (known as the Florida Current) found in the Gulf Stream system. The warm, fast flowing, deep, salty water contains myriad life forms, and presents a highly corrosive environment to most common building materials. The minimization of galvanic and crevice types of corrosion offers the most formidable challenge to the designer. S.F.

N81-21621# Sandia Labs., Albuquerque, N. Mex. Nondestructive Testing Technology Div.

AN ACOUSTIC MEASUREMENT OF BOILING INSTABILITIES IN A SOLAR RECEIVER

Alan G. Beattie 1 Oct. 1980 56 p

(SAND-80-2409) Avail: NTIS HC A04/MF A01

An acoustic technique was developed and used to search for boiling instabilities in the protoype receiver for the Barstow 10 MW Solar Thermal Pilot Plant. Instabilities, consisting of movements of the transition zone between regions of nucleate and film boiling, were observed. The periods of these fluctuations ranged between three and fifteen seconds with no indications of preferred frequencies. The peak to peak amplitudes of the fluctuations averaged 0.4 meters under steady state conditions at absorbed power levels between 2.0 and 3.2 MW. Transient fluctuations with amplitudes up to 2.0 meters were also seen. These transients usually lasted between 30 and 300 seconds. It was not possible to pinpoint the causes of these transients.

Author

N81-21622# Sandia Labs., Albuquerque, N. Mex. Energy Systems Studies Div.

SURVEY OF US INDUSTRIAL PROCESS HEAT USAGE DISTRIBUTIONS

J. J. Iannucci 1981 30 p refs Sponsored by DOE

(SAND-80-8234) Avail: NTIS HC 03/MF A01

The energy use characteristics of industry are examined in terms of the potential for penetration of solar thermal energy into the industrial process heat market. Data on 1972 United States industrial energy consumption (grouped by standard industrial classifications) were used along with the number of energy consuming establishments to generate estimates of the average consumption rate (megawatts) of energy at any site. Known temperature requirements for those industrial types were incorporated to calculate the power ratings required at various temperatures. These data were combined to yield distributions of energy consumption facility sizes at various temperatures. In terms of number of facilities, the small, lower temperature end users dominate. However, in terms of total energy consumed, the larger users (> 10 MW) and higher temperatures dominate. J.M.S.

N81-21623# Los Alamos Scientific Lab., N. Mex.

GEOTHERMAL ENERGY ENHANCEMENT BY THERMAL FRACTURE

Ruth B. Demuth and Francis H. Harlow 1980 70 p ref Sponsored by DOE

(LA-8428) Avail: NTIS HC A04/MF A01

A large, vertical, circular fracture created deep within hot rock is connected to the surface through two holes. The inlet provides a source of cold water and the outlet extracts heated water. Cooling of the rock produces thermal stresses that fracture the rock adjacent to the primary crack, thereby enhancing the heat extraction rate by means of convective transport. The properties of the thermal fracture network vary with position and time. The REX code for high-speed computer was written and used to study the coupled processes of primary-crack flow and lateral thermal fracture heat transport. Calculations for elapsed times of 100 yr show that thermal fracture enhancement can double the heat extraction rate over the results from conduction alone. S.F.

N81-21624# Battelle Pacific Northwest Labs., Richland, Wash.

THE ECONOMICS OF RESIDENTIAL ENERGY EFFICIENCY

Richard P. Mazzucchi and Wally J. Hopp Jun. 1980 16 p refs

(Contract DE-AC06-76RL-01830)

(PNL-SA-8696; CONF-800828-3) Avail: NTIS HC A02/MF A01

The building thermal analysis program is utilized to analyze various measures for reducing energy consumption in single-family dwellings in northeastern Oregon. The results from the program are combined with energy price data and other economic assumptions to produce a ranking of the conservation measures according to their economic attractiveness. An evaluation is given of the utility and cost-effectiveness of the program as a tool for the design of energy efficient housing for specific climatic locations. S.F.

N81-21625# Houston Univ., Tex. Energy Lab.

A FEASIBILITY STUDY: MANAGEMENT OF SELECTED ASPECTS OF THE ADVANCED SOLAR THERMAL TECHNOLOGY PROGRAM BY A UNIVERSITY CONSORTIUM Final Report, 1 Jun. 1980 - Feb. 1981

A. F. Hildebrandt and J. H. U. Brown Feb. 1981 21 p refs

(Contract DE-AC03-80SE-11422)

(SAN-1422-1) Avail: NTIS HC A02/MF A01

To increase the involvement of universities and advanced technology industries in task-oriented supporting research for the Solar Thermal Energy System (STES) program, organizational issues are considered. A generic and discipline focused program is considered which could provide applied research capabilities for all elements in the STES program. A management structure is presented which is organized around the management and research capabilities of universities. S.F.

N81-21626# Atomic Energy Commission Research Establishment, Riso (Denmark). Engineering Dept.

INVESTIGATIONS OF STRUCTURAL DYNAMICS ON THE GEDSER WTG AND ON NEW DANISH WIND TURBINES

P. Lundsager and C. J. Christensen Dec. 1978 57 p refs Presented at 1st Meeting of Experts on Struc. Dyn./IEA Implementary Agreement for Cooperation in the Develop. of Large Scale Wind Energy Conversion Systems, Munich, Oct. 1978

(RISOE-M-2146; ISBN-87-550-0695-7; ISSN-0418-6435) Avail: NTIS HC A04/MF A01

Structural dynamic analyses are reviewed for an existing wind turbine and two prototypes. The upwind located rotors have an inner part with a tubular steel beam and glass reeinforced plastic (GRP) shells and outer part of a spun GRP main spar with GRP shells. Results from a conventional beam model are presented. Structural and electrical output data from the operating turbine are summarized. A comparison of the spectrum of the electrical power output and a power spectrum of the torque in the induction generator shaft is made with a mathematical model of the system. Author (ESA)

N81-21627# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Bereich Neue Technologien.

HIGH TEMPERATURE WATER VAPOR ELECTROLYSIS (HOT ELLY) Final Report

Wolfgang Doenitz, Hajo Hermeking, Ingo Kitzmann, Alfred Koch, Reinhard Roettenbacher, Wolfgang Schaefer, Rainer Schmidberger, Juergen Schumacher, and Hartwig vonZuelow Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 273 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-051; ISSN-0340-7608) Avail: NTIS

HC A12/MF A01

The practicability of high temperature water vapor electrolysis was demonstrated on a laboratory scale. The component raw materials selection is described, and the manufacture of high temperature electrolysis cells is delineated. Electrolytic operation of single cells and of tubular batteries built of series connected cells, at ambient as well as at high pressure, is described. Results show that the specific electrical energy necessary for this method of hydrogen production is significantly lower than in conventional electrolysis processes. Author (ESA)

N81-21628# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

ANALYSIS OF THE UTILIZATION OF LUNAR RESOURCES FOR SPACE POWER SYSTEMS. PART 1: SYSTEM DEFINITION AND MODEL STRUCTURE

H. H. Koelle and B. Johenning 1980 44 p refs

(ILR-Mitt-73/1980-Pt-1) Avail: NTIS HC A03/MF A01

The possible utilization of lunar resources for manufacturing and assembling solar power satellites in a geostationary orbit is examined. The system consists of three complexes (Earth, Moon and geostationary orbit) having 10 subsystems and 49 elements. Based on functional considerations, preliminary specifications for these elements are given. Some qualitative statements are made concerning energy and manpower requirements. Emphasis is on the investments needed for the lunar complex (mass, energy, manpower) to deliver a given amount of raw and construction materials to orbit for the assembly of solar power satellite systems to produce electrical energy for consumption on the Earth's surface. Author (ESA)

N81-21629# Texas A&M Univ., College Station. Dept. of Chemistry.

METAL CHELATE CATALYSTS FOR FUEL CELLS Annual Report

Minoru Tsutsui, Ronald Darby, Ralph White, Gilbert Albelo, Paul Deininger, and J. Balliew Aug. 1980 28 p

(Contract GRI-5014-363-0174)

(PB81-132953; GRI-79/0059) Avail: NTIS HC A03/MF A01 CSCL 10B

An aromatic dialdehyde, 9,9-dimethyl-4,5-xanthenedicaroxaldehyde, suitable for the synthesis of a stacked polymer of meso-tetraphenyl-porphyrin was synthesized in high yield. From this, a dimer was formed. The cobalt complex of this dimer, along with metal complexes of polymers of phthalocyanine and TAA were tested for catalytic activity for the reduction of oxygen. The stacked dimer of TPP and the sheet polymer of TPP exhibited greater catalytic activity as the cobalt complexes than all other compounds tested with the exception of CoTAA. GRA

N81-21630# General Accounting Office, Washington, D. C. Energy and Minerals Div.

IMPROVED DATA AND PROCEDURES NEEDED FOR DEVELOPMENT AND IMPLEMENTATION OF BUILDING ENERGY PERFORMANCE STANDARDS

23 Dec. 1980 38 p

(PB81-138422; EMD-81-2) Avail: NTIS HC A03/MF A01 CSCL 13A

Energy conservation standards for new buildings being developed by the Department of Energy are discussed. Specifically, it addresses: what still needs to be done before sound standards can be issued; the need to transfer implementation responsibility for the standards from the Department of Housing and Urban Development to the Department of Energy; and the inappropriateness of the proposed sanction for noncompliance in view of the large decrease in expected energy savings. GRA

N81-21631# Resource Planning Associates, Inc., Washington, D. C.

REGIONAL ANALYSIS OF RESIDENTIAL/COMMERCIAL GAS DEMAND Final Report

Dec. 1980 93 p

(Contract GRI-5014-310-0238)

(PB81-134496; RPA-RA-80-0429(2); GRI-80/0011) Avail: NTIS HC A05/MF A01 CSCL 13A

The market for the following systems for space conditioning is analyzed; deluxe gas furnace/central air-conditioner; oil furnace/central air-conditioner; electronic furnace/central air-conditioner; gas pulse-combination furnace/central air-conditioner; gas absorption heat pump; gas mechanical heat pump; advanced electric heat pump. The methodology used forecasting regional characteristics affecting regional gas demand; forecasting regional gas demand; and analyzing the economics of and developing market shares for each of the above systems regionally. GRA

N81-21632# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering.

AERODYNAMIC CHARACTERISTICS OF THE TARP (TOROIDAL ACCELERATOR ROTOR PLATFORM) WIND ENERGY CONVERSION SYSTEM Final Report, 1978 - 1979

Robert E. Duffy, Chris Jaran, and Charles Ungermann Feb. 1980 72 p refs

(PB81-140675; NYSERDA-80-7) Avail: NTIS HC A04/MF A01 CSCL 10A

Augmented wind energy conversion systems (WECS) are designed to increase the ambient wind velocity at the turbine blades. The Toroidal Accelerator Rotor Platform (TARP) is an augmenting structure for use with horizontal axis WECS. Its shape resembles that of a horizontally oriented wheel rim and is intended to be built into or retrofitted onto structures built for other purposes, which could increase the use of WECS in urban areas. Variations of the basic TARP structure, about three feet in diameter, were tested in a wind tunnel to determine the optimum design. The model system produced up to 4.5 times the power which the rotor and generator extracted without the TARP. GRA

N81-21633# Federal Lab. Consortium, Washington, D. C.

THE ENERGY LINK CATALOG. VOLUME 2: ENERGY RESOURCE CATALOG

P. Thomas Stiko Feb. 1980 136 p Prepared in cooperation with San Diego Science and Technology Action Center, Calif. and Naval Weapons Center, China Lake, Calif.

(Grant NSF ISP-78-22221)

(PB81-140824; NSF/RA-800264; LLL-MISC-138-2) Avail: NTIS HC A07/MF A01 CSCL 10A

The Energy Link Project, through the development of a simplified resource/technology locator system, has improved the accessibility and usability of resources from the Federal Laboratory system in the energy field. This locator system was designed from the point of view of local government management. This orientation allows the user to identify his needs and then retrieve the resources applicable to alternative solutions from the Federal Laboratory system. Instructions are provided on how to use the catalog and obtain publications. Entries are categorized and include title, abstract, contact, and availability. GRA

N81-21634# New York Univ., N. Y. Dept. of Applied Science.

THE LEBOST WIND TURBINE EXPERIMENTAL PROGRAM Progress Report, Sep. 1978 - May 1980

G. Miller, M. Hoffert, B. Rugg, and D. Corren May 1980 55 p refs

(PB81-141467; NYSERDA-80-16) Avail: NTIS HC A04/MF A01 CSCL 10A

The Lebost Wind Turbine is unique in two respects: it consists of a vertical axis turbine which is encased in a perforated hemispherical shroud which acts to focus or concentrate ambient wind energy onto the turbine blades; and the turbine's shaft is directly coupled to a water twister/heat brake assembly which heats water via direct mechanical agitation; in other words, the turbine can be used to heat water without electrical interface. Results of an experimental field test/evaluation of a 20 foot diameter lebost turbine are reported. GRA

N81-21635# Aeronautical Research Inst. of Sweden, Stockholm.

THE VELOCITY INDUCED BY THE WAKE OF A WIND TURBINE IN A SHEAR LAYER, INCLUDING GROUND EFFECT

Bo C. A. Johansson Jun. 1980 43 p

(PB81-142184; FFA-133) Avail: NTIS HC A03/MF A01 CSCL 10A

A theory is developed for the calculation of the velocity field induced by the wake of a horizontal axis wind turbine in a

wind shear layer and in the vicinity of a plane ground surface, when the force distribution of the turbine is known. The turbine is approximated by a disk area of continuous distributions of thrust and force parallel to the disk plane. Its wake is represented by a semi-infinite cylinder of distributed vorticity. A numerical example is calculated. The theory is based upon assumptions strictly valid only for small perturbations of the undisturbed flow. However, the results may have a wider range of applicability. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-21636*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SUMMARY OF 1978 SOUTHEASTERN VIRGINIA URBAN PLUME STUDY: AIRCRAFT RESULTS FOR CARBON MONOXIDE, METHANE, NONMETHANE HYDROCARBONS, AND OZONE

Gerald F. Hill, Glen W. Sachse, and Wesley R. Cofer, III Mar. 1981 52 p refs

(NASA-TM-81930; L-13758) Avail: NTIS HC A04/MF A01 CSCL 13B

The characteristics of the Southeastern Virginia urban plume were defined with emphasis on the photon-oxidant species. The measurement area was a rectangle, approximately 150 km by 100 km centered around Cape Charles, Virginia. Included in this area are the cities of Norfolk, Virginia Beach, Chesapeake, Newport News, and Hampton. The area is bounded on the north by Wallops Island, Virginia, and on the south by the Hampton Roads area of Tidewater Virginia. The major axis of the rectangle is oriented in the southwest-northeast direction. The data set includes aircraft measurements for carbon monoxide, methane, nonmethane hydrocarbons, and ozone. The experiment shows that CO can be successfully measured as a tracer gas and used as an index for determining localized and urban plumes. The 1978 data base provided sufficient data to assess an automated chromatograph with flame ionization detection used for measuring methane and nonmethane hydrocarbons in flight. A.R.H.

N81-21637# Texas Univ. at Arlington. Dept. of Chemical Engineering.

PLUME MECHANICS AND PARTICLE GROWTH PROCESSES Final Report

J. R. Brock 10 Feb. 1981 14 p refs

(Contract DAAG29-79-C-0123; Grant DAAG29-78-G-0123)

(AD-A096081; ARO-16103.1-AC) Avail: NTIS HC A02/MF A01 CSCL 19/1

Numerical models have been developed for studying aerosol growth processes in dispersing smoke plumes. The principal growth processes are coagulation and condensation/evaporation. For coagulation, the existence of asymptotic limit distributions has been demonstrated. It is shown that the condensation/evaporation process can lead to multimodal particle size distributions. The aerosol growth processes have been incorporated in general K-theory model for dispersion of smoke plumes. Some of the results from field measurements of plumes from smoke munitions support conclusions based on our numerical model studies. GRA

N81-21638# Oak Ridge National Lab., Tenn.

COMPARISON OF THE COMRADEX-IV AND AIRDOS-EPA METHODOLOGIES FOR ESTIMATING THE RADIATION DOSE TO MAN FROM FROM RADIONUCLIDE RELEASES TO THE ATMOSPHERE

Charles W. Miller, F. Owen Hoffman, and Donald E. Dunning, Jr. Jan. 1981 79 p refs

(Contract W-7405-eng-26)

(ORNL/TM-6495) Avail: NTIS HC A05/MF A01

The COMRADEX-IV code was designed to provide a means of assessing potential radiological consequences from postulated power reactor accidents. The AIRDOS-EPA code was developed primarily to assess routine radionuclide releases from nuclear facilities. Although a number of different calculations are performed by these codes, three calculations are in common - atmospheric dispersion, estimation of internal dose from inhalation, and estimation of external dose from immersion in air containing gamma emitting radionuclides. The models used in these calculations were examined and found, in general, to be the same. DOE

N81-21639# New Mexico State Univ., Las Cruces. , New Mexico Energy Inst.

ENVIRONMENTAL OVERVIEW FOR THE DEVELOPMENT OF GEOTHERMAL RESOURCES IN THE STATE OF NEW MEXICO Final Report

M. Bryant, Arlene H. Starkey, and William A. Dick-Peddie Jun. 1980 268 p refs Prepared for California Univ., Livermore. Lawrence Livermore Lab.

(Contract W-7405-eng-48)

(UCRL-15317) Avail: NTIS HC A12/MF A01

Technologies and environmental impacts are considered at all points on the pathway of development resource exploration; well field, plant and transmission line construction; and plant operation. The technologies for electrical generation direct, dry steam conversion; separated steam conversion; single flash conversion, separated steam/single flash conversion and binary cycle conversion and the heat exchanger, down the hole heat exchanger and heat pump are described. A summary of the geothermal technologies planned or in operation within New Mexico geothermal areas is provided. A review of regulations that affect geothermal development and its related environmental impact in New Mexico is presented. DOE

N81-21640# California Univ., Livermore. Lawrence Livermore Lab.

MANAGEMENT PLAN FOR FISCAL YEAR 1981: ENVIRONMENTAL CONTROL TECHNOLOGY PROJECT GEOTHERMAL DEVELOPMENT

W. F. Morris and F. B. Stephens 14 Oct. 1980 31 p refs

(Contract W-7405-eng-48)

(UCID-18903) Avail: NTIS HC A03/MF A01

The management of four assessment tasks are discussed. The tasks were: current progress in H2S abatement technology; solid wastes from geothermal power production operations: characterization, handling, and disposal; problems associated with the use of agricultural drainage water for geothermal power plant cooling in the Imperial Valley; and liquid dominated, low total dissolved solids geothermal resources; characterization and evaluation of potential problems due to composition. DOE

N81-21641# Department of Energy, Washington, D. C. Office of Fossil Energy.

ENVIRONMENTAL DEVELOPMENT PLAN: COAL LIQUEFACTION

Aug. 1980 78 p

(DOE/EDP-0044) Avail: NTIS HC A05/MF A01

This Environmental Development plan (EDP) examines environmental concerns being evaluated for the technologies in DOE's Coal Liquefaction Program. It identifies the actions that are planned or underway to resolve these concerns while the technologies are developed. Research is scheduled on the evaluation and mitigation of potential environmental impacts. The major unresolved environmental concerns associated with the coal liquefaction subactivities and projects are summarized. DOE

N81-21642# Battelle Pacific Northwest Labs., Richland, Wash.

ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM CONCEPT DEVELOPMENT AND EVALUATION PROGRAM-ELECTROMAGNETIC

K. A. Davis, W. B. Grant, E. L. Morrison, and J. R. Juroshek Jan. 1981 93 p refs Prepared in cooperation with Institute for Telecommunication Sciences

(Contract DE-AC06-76RL-01830)

(DOE/ER-0096) Avail: NTIS HC A05/MF A01

An initial quantitative indication of the scope of potential electromagnetic compatibility (EMC) problems is provided and the importance of EMC considerations in rectenna site selection are indicated. The effects of satellite power system (SPS) microwave emissions on important categories of electronic systems and equipment are summarized, with many examples of test results and demonstrated techniques for mitigation of

problems encountered. The SPS effects on other satellite systems are presented. Astronomical research frequently involves measurement of extremely low levels of electromagnetic radiation and is thus very susceptible to interference. The concerns of both radio astronomy with microwave emissions from SPS and optical astronomy with sunlight scattered from SPS spacecraft are discussed. Summaries of mitigation techniques, cost estimates, and conclusions are presented. DOE

N81-21643# Michigan Univ., Ann Arbor. Dept. of Chemistry.
MEASUREMENT OF SURFACE FLUXES OF AIR POLLUTANTS Final Report
D. H. Stedman Jan. 1981 96 p refs
(Contracts DE-AS02-78EV-04958; EP-78-S-02-4958; Grant EE-78-S-02-4958)
(DOE/EV-04958-T1) Avail: NTIS HC A05/MF A01

Research progress is reported on the design, construction, and delivery of appropriate air pollutant detectors. The pollutants studied included ozone, nitrogen oxides, and sulfur species. DOE

N81-21644# Los Alamos Scientific Lab., N. Mex.
HORIZONTAL DIFFUSION IN THE ATMOSPHERE: A LAGRANGIAN-DYNAMICAL THEORY
F. A. Gifford Jan. 1981 20 p refs
(Contract W-7405-eng-36)
(LA-8667-MS) Avail: NTIS HC A02/MF A01

A form of Langevin's equation is derived that is applicable to the atmospheric diffusion problem. The resulting equation for the particle displacement variance has limits at small and large diffusion times equal to asymptotic predictions of statistical diffusion theories but provides, in addition, estimates over the broad, middle range of diffusion, which is important in regional and large scale atmospheric applications. Predictions of the theory compare well with standard atmospheric diffusion data sets over a range of diffusion times, from seconds to days. When parameters of the theory are determined from short range plume diffusion data, the theory predicts large scale eddy diffusivity, K, in the known atmospheric range, a striking confirmation of the ability of this theory to describe atmospheric diffusion. DOE

N81-21645# Argonne National Lab., Ill. Materials Science Div.
STATE-OF-THE-ART REVIEW OF MATERIALS-RELATED PROBLEMS IN FLUE GAS DESULFURIZATION SYSTEMS
P. S. Maiya Oct. 1980 45 p refs
(Contract W-31-109-eng-38)
(ANL-80-59) Avail: NTIS HC A03/MF A01

The chemical and mechanical environments to which the structural components used in flue gas desulfurization (FGD) are exposed are discussed. Information pertinent to various FGD processes currently in use are reviewed with particular emphasis on lime/limestone scrubbing technology, so that the materials problems and processing variables encountered in FGD systems can be better defined and appreciated. The report also describes the materials currently used and their performance to date in existing wet scrubbers. With more extensive use of coal and flue gas scrubbers by utilities and other segments of private industry, a better understanding of the material failure mechanisms, performance limitations, and potential problem areas is required for the design of more reliable and cost effective FGD systems. To meet the above objectives, a materials evaluation program is proposed. DOE

N81-21646# Texas Univ., Austin. Bureau of Economic Geology.
ENVIRONMENTAL ANALYSIS OF GEOPRESSURED-GEOTHERMAL PROSPECT AREAS, DEWITT AND COLORADO COUNTIES, TEXAS Final Report, 1 Mar. - 31 Aug. 1979
Thomas C. Gustavson, Florette S. Reeder, and Elizabeth A. Badger Feb. 1980 282 p refs
(Contract DE-AS05-79ET-27127)
(DOE/ET-27127/1) Avail: NTIS HC A13/MF A01

Information collected and analyzed for a preliminary environmental analysis of geopressured geothermal prospect areas in Colorado and DeWitt Counties, Texas is presented. Specific environmental concerns for each geopressured geothermal prospect area are identified to: (1) conduct an environmental analysis to identify more and less suited areas for geopressured test wells; and (2) provide an environmental data base for development of geopressured geothermal energy resources. A series of maps and tables are included to illustrate environmental characteristics including: geology; water resources; soils; current land use; vegetation; wildlife; and meteorological characteristics; and additional relevant information on cultural resources, power and pipelines, and regulatory agencies. DOE

N81-21647# Prins Maurits Lab. TNO, Rijswijk (Netherlands).
DETERMINATION OF THE CONCENTRATION OF HARMFUL SUBSTANCES IN THE ATMOSPHERE OF THE WELDING DEPARTMENT OF THE 575 T.D. CENTRAL WORKSHOP IN UTRECHT
R. Roos and H. L. Boter Feb. 1979 29 p refs In DUTCH; ENGLISH summary
(PML-1979-009; TDCK-71761) Avail: NTIS HC A03/MF A01

The concentration of toxic gases and metal dust to which personnel of a welding shop are exposed was determined. The concentration of carbon monoxide and nitrogen oxides met the Dutch Hygienic Standards (MAC-values). The respirable metal dust concentration exceeded the MAC-value. The total concentrations of 24 metal oxides found are listed. Author (ESA)

N81-21648# Washington State Water Research Center, Pullman.
SAVING THE LAKES
David C. Flaherty Jun. 1980 49 p refs
(Contract DI-14-34-0001-0415)
(PB81-131138; W81-00549; OWRT-C-90009-T(0415)(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

Research studies involved Liberty Lake, Lake Coeur d'Alene, Lake Washington, Lake Sammamish, Moses Lake, Long Lake, and Newman and Williams Lakes. Sewers and sewage-treatment plants are being constructed to intercept nutrients and other pollutants which formerly entered the lakes unchecked. Separate reports on each of the major Washington Lakes are presented. GRA

N81-21649# Energy and Environmental Analysis, Inc., Arlington, Va.
MOTOR VEHICLE EMISSIONS TECHNOLOGY Interim Report
Frank Slaveter 30 Jun. 1980 109 p refs Sponsored by the National Commission on Air Quality
(PB81-127573; AQ-7243-2g; Rept-7) Avail: NTIS HC A06/MF A01 CSCL 13F

This is an interim report in a study to evaluate the factors which cause vehicles to fail to meet emission standards in use, determine how adequately the EPA motor vehicle emission factors characterize in-use emission levels of vehicles, and determine appropriate adjustments, if any, that should be made to the EPA emission factors. A survey of the types of emission control technologies used on vehicles produced over the past five years and projected to be used on future model year vehicles is presented. GRA

N81-21650# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
AMBIENT AIR NON-METHANE HYDROCARBON MONITOR Final Report, Oct. 1977 - Jul. 1980
Darrell E. Burch Dec. 1980 49 p
(Contract EPA-68-02-2776)
(PB81-120008; U-6624; EPA-600/2-80-201) Avail: NTIS HC A03/MF A01 CSCL 14B

The monitor consists of a pump and manifold system along with two basic instruments, a methane monitor and a flame-ionization detector (FID). The concentration of non-methane hydrocarbons is found by subtracting the methane concentration from the concentration. The noise-equivalent concentrations (peak-to-peak) of the methane monitor and the FID are approximately 50 ppb and 5 ppb of carbon, respectively. The estimated uncertainty in the measurement of a typical low-level NMHC concentration is between 20 ppb and 50 ppb. Concentrations as high as approximately 70 ppm can be measured. GRA

N81-21651# TRW, Inc., Research Triangle Park, N.C. Environmental Engineering Div.

PREVENTION OF SIGNIFICANT DETERIORATION WORKSHOP MANUAL Final Report
Leigh Hayes, Jeff Shumaker, James Avery, and William Warren-Hicks Oct. 1980 192 p refs
(Contract EPA-68-02-3174)
(PB81-136459; EPA-450/2-80-081) Avail: NTIS HC A09/MF A01 CSCL 13B

This manual is broken into two main parts: (1) application guidance (sources); and (2) application review. The application guidance part is broken down in the following subparts, applicability, BACT, air quality analyses, additional impacts analysis as viewed from the prospective source. The application review part covers the same subparts from the reviewing Agencies view-point. GRA

N81-21652# Clemson Univ., S.C. Water Resources Research Inst.
SCALE REDUCTION IN PHYSICAL HYDRAULIC MODELS OF THERMAL DISCHARGES
Ben L. Sill Sep. 1980 146 p refs
(Contract DI-14-34-0001-8116)
(PB81-126526; WRRI-90; W81-00327; OWRT-B-119-SC(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

An experimental procedure was developed to study the behavior of the water air heat transfer in indoor physical hydraulic models of thermal discharges. Using this procedure, the value of the indoor heat exchange coefficient was determined and used to calculate the allowable distortion of scale in a far field thermal discharge model. In preparation for an actual model study, scaling requirements were reviewed for the following far field processes: convective spread, turbulent dispersion, head loss, and surface cooling. The necessary distortion of scale differs for each of the different mechanisms. The theory and procedures developed were tested by modeling Lake Belews, a thermally loaded lake near Winston Salem, N.C. GRA

N81-21653# California Univ., Riverside. Statewide Air Pollution Research Center.
CHEMICAL CONSEQUENCES OF AIR QUALITY STANDARDS AND OF CONTROL IMPLEMENTATION PROGRAMS Final Report, 5 Jul. 1978 - 31 Oct. 1979
James N. Pitts, Jr., Arthur M. Winer, William P. L. Carter, George J. Doyle, Richard A. Graham, and Ernesto C. Tuazon Jun. 1980 408 p refs
(PB81-137697; ARB-R-80/131) Avail: NTIS HC A18/MF A01 CSCL 07D

The environmental chamber facility established at the Statewide Air Pollution Research Center, University of California, Riverside, under a joint California Air Resources Board - University of California program was employed in several investigations. Data was obtained concerning the photooxidation of toluene, benzaldehyde, and cresols in NOx-air systems. These data were then used to develop and validate a detailed chemical mechanism for the photooxidation of aromatic hydrocarbons. The previous oxidant-hydrocarbon-NOx data base obtained at SAPRC was extended by generating new data concerning the temperature dependence of photochemical smog formation and of smog chamber effects. GRA

N81-21654# Radian Corp., Austin, Tex.
HOUSTON AEROSOL CHARACTERIZATION STUDY Interim Report, Jun. 1978 - Nov. 1979
Gary K. Tannahill, David C. Jones, and W. David Balfour Dec. 1980 159 p refs
(Contract EPA-68-02-2954)
(PB81-120818; EPA-600/3-80-098) Avail: NTIS HC A08/MF A01 CSCL 13B

An intensive field study of ambient aerosols was conducted in Houston between September 14 and October 14, 1978. Measurements at 12 sites were made using two relocatable monitoring systems instrumented for aerosol gaseous pollutants, a network of high volume samplers and automated virtual dichotomous samplers, and an upper air system incorporating pilot balloon launchers at two locations. Monitoring was conducted to characterize four diverse sources of air impacting Houston air quality; ship channel area, the urban area, incoming maritime air, and incoming continental air. The data are organized into a computer compatible, uniform data archive for further analysis. GRA

N81-21655# Research Triangle Inst., Research Triangle Park, N. C. Operations Analysis Div.
EMISSIONS INVENTORY SYSTEM/AREA SOURCE (EIS/AS) TEST RUN SERIES DOCUMENTATION
Larry R. McMaster Oct. 1980 282 p
(Contract EPA-68-02-3011)
(PB81-135980; EPA-450/4-80-018) Avail: NTIS HC A13/MF A01 CSCL 13B

The test run series is divided into two major areas: basic test runs and ad hoc test runs. The basic test runs exercise each program in EIS/AS at least once and provide the user with a means of determining whether or not his installation of EIS/AS has been successful. The ad hoc test runs further exercise the capabilities of the EIS/AS programs. They also provide the user with examples of how various combinations of EIS/AS programs may be used to generate certain reports or to accomplish special tasks. Any programs added to the original EIS/AS system are exercised by ad hoc test runs. GRA

N81-21656# Research Triangle Inst., Research Triangle Park, N. C. Chemistry and Life Sciences Div.
GC/MS ANALYSIS OF AMBIENT AIR AEROSOLS IN THE HOUSTON, TEXAS AREA Final Report, Aug. 1978 - Dec. 1979
Charles M. Sparacino Nov. 1980 263 p refs
(Contract EPA-68-02-2963)
(PB81-126377; RTI/1680/00; EPA-600/2-80-194) Avail: NTIS HC A12/MF A01 CSCL 07D

Ambient air aerosols and vapor samples were collected in the Houston, Texas area using three different samplers. A high volume sampler and dichotomous sampler were used for the collection of particulate matter; vapor-phase organic samples were collected with a resin trap sampler. Vapors were analyzed by thermal desorption from the resin bed followed by glass capillary gas chromatography/mass spectrometry. The presence of many saturated and unsaturated hydrocarbons was found in all samples. Vapor-phase organics consisted predominatly of hydrocarbons, alkylated benzenes and some chlorinated compounds. GRA

N81-21657# Research Triangle Inst., Research Triangle Park, N. C.
ATMOSPHERIC CHEMISTRY OF SELECTED SULFUR-CONTAINING COMPOUNDS. OUTDOOR SMOG CHAMBER STUDY, PHASE 2 Final Report, Jul. 1978 - Mar. 1980
J. E. Sickles, II and R. S. Wright Jan. 1981 224 p refs
(Contract EPA-68-02-2969)
(PB81-141574; EPA-600/7-81-002) Avail: NTIS HC A10/MF A01 CSCL 13B

The photochemical behavior of mixtures of selected sulfur containing species, hydrocarbons, and nitrogen oxides was examined in outdoor smog chambers. Sulfur dioxide, H2S, CH3SH, COS, and thiophene are the sulfur species tested. A surrogate ambient hydrocarbon mixture comprised of 25 percent propene and 75 percent butane known as the EKMA mix was selected. An experimental matrix was designed where initial EKMA mix concentrations ranged from 0.0 to 2.0 ppmC, initial NOx concentrations ranged from 0.0 to 0.4 ppm, resulting in initial HC/NOx ratios of 0. to 40. The impact of the sulfur species on the behavior of the EKMA Mix-NOx system was examined. GRA

N81-21658# TRW Systems Group, Redondo Beach, Calif.
EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS. VOLUME 4: COMMERCIAL/INSTITUTIONAL COMBUSTION SOURCES Final Report, Sep. 1976 - Dec. 1980
N. F. Surprenant, P. Hung, R. Li, K. T. McGregor, and W. Pilspanen Jan. 1981 207 p refs Prepared in cooperation with GCA Corp.
(Contract EPA-68-02-2197)
(PB81-145187; EPA-600/7-81-003B; IERL-RTP-1122) Avail: NTIS HC A10/MF A01 CSCL 13B

Tests were conducted at 22 external and six internal combustion sites. Results of the environmental assessment indicate that air emissions from these sources represent a potential environmental hazard. Emissions of criteria pollutants, except for

CO, from most of the source categories tested are environmentally significant. Particulate, SO4, and SO3 emissions from the coal and wood fired sources are also significant. Several potentially hazardous POM compounds were tentatively identified in the emissions from solid fuel fired sources, particularly from one wood-fired stoker tested. GRA

N81-21659# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
EFFECTS OF AIR POLLUTANTS ON MEDITERRANEAN AND TEMPERATURE FOREST ECOSYSTEMS Final Forest Service General Technical Report
Paul R. Miller Dec. 1980 263 p refs Presented at a Symp. Held at Riverside, Calif., 22-27 Jun. 1980
(PB81-133720; FSGTR-PSW-43) Avail: NTIS HC A12/MF A01 CSCL 06F

Single species-single pollutant relationships are described. The interactions of producers, consumers, and decomposers under pollutant stress, and the use of ecological systems models for interpreting and predicting pollutant effects are discussed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-21660 Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE MAGNETOSPHERE, AERONOMICA ACTA A - NO. 216, 1980 [LA MAGNETOSPHERE, AERONOMICA ACTA, A - NO. 216, 1980]
J. Lemaire 1980 25 p In FRENCH; ENGLISH summary Presented at Conf., Brussels, 22 Nov. 1979
(Aeronomica-Acta-A-216-1980) Avail: Issuing Activity

The magnetosphere is the region containing all the magnetic field lines of the Earth. The solar wind in the form of ionized hydrogen continuously emitted by the Sun, interacts with the geomagnetic field. It is deflected around the magnetospheric cavity like an air flow around a solid object. The boundary of the magnetosphere is called the magnetopause. It is located at a distance of about ten Earth radii in the direction of the Sun. The surface of the magnetopause extends several thousand Earth radii into the solar wind flow direction. Although aurorae borealis were observed long ago, it is less than twenty years since these phenomena were shown to be optical proving the existence of a terrestrial magnetosphere. The general properties and the many different regions of the magnetosphere are described.
Author (ESA)

N81-21661 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ON THE ENTROPY BALANCE OF THE EARTH-ATMOSPHERE SYSTEM
G. Nicolis and C. Nicolis 1980 41 p refs Submitted for publication
(Aeronomica-Acta-A-218-1980) Avail: Issuing Activity

The entropy balance associated with a Budyko-Sellers climatic model is developed. It is shown that different regimes associated with decreasing as well as increasing values of entropy production (which measures the rate of dissipation in the system) in the course of time are possible. An explicit criterion of climatic stability is also derived which is expressed in terms of thermodynamic quantities related to excess entropy production. The results are illustrated on simple cases involving diffusive energy transport. A comparison with an approach using an unconstrained energy balance equation is also made. Author (ESA)

N81-21662# Naval Research Lab., Washington, D. C.
PLUMEX 2. A SECOND SET OF COINCIDENT RADAR AND ROCKET OBSERVATIONS OF EQUATORIAL SPREAD-F Interim Report
E. P. Szuszczewicz, R. T. Tsunoda, R. Narcisi, and J. C. Holmes 30 Dec. 1980 81 p refs
(RR0330244)
(AD-A096279; NRL-MR-4344) Avail: NTIS HC A05/MF A01 CSCL 04/1

PLUMEX II was the second in a two-rocket operation that successfully executed space- and time-coincident measurements of equatorial spread-F. The first launch operation (PLUMEX I) was conducted during the late phase in the development and decay of spread-F; major radar plume features were relatively stable with respect to vertical drifts, and the most intense regions of radar backscatter were beginning to decay. The PLUMEX II conditions were substantially different, with the rocket having been launched into the mid-phase of well developed spread-F, i.e., a ground-based ionosonde showed full range spread while Altair radar maps of meter-size irregularities displayed backscatter plumes that penetrated to the topside F-layer and continued rising with time. GRA

N81-21663# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
EVALUATION OF LOCATION ACCURACY USING Pn AND Pg ARRIVALS
A. C. Chang and D. P. J. Racine 30 May 1980 23 p refs (Contract F08606-79-C-0007; DARPA Order 2551)
(AD-A095876; SDAC-TR-79-4) Avail: NTIS HC A02/MF A01 CSCL 17/10

Seismic event locations obtained by using P sub g and P sub n arrivals may cause severe errors because the Earth's crust is laterally heterogeneous. Location errors are attributed to the fact that crustal velocities and thicknesses for each source-to-station path are different from those of the standard crustal model used in the location program. To overcome this difficulty, we have installed a number of crustal models in a location program and made it possible for each station to be assigned an appropriate model. Travel times for each phase are computed by using the selected earth model and the specified phase. The merit of this method is evaluated by relocating 12 explosions in the western United States. When each station model was chosen individually from a number of regional models, location errors were slightly larger than errors using only one (regional) model for all stations. However, errors were reduced when each station was assigned its own model for a set of finely localized crustal models. Errors were also reduced when the local crustal model appropriate to the source region was used for all stations. This suggests that a crustal model for the source and a separate model for each station would result in even better locations. The addition of P sub g arrivals to the set of P sub n arrival reduced location error by about 30%. However, the difference is not great enough for this small sample but we can be sure that it is significantly different from zero. GRA

N81-21664# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
PRESENT STATUS AND DYNAMIC PLANNING FOR AUTOMATIC ASSOCIATION PROGRAMS
John H. Gonzc 29 Feb. 1980 52 p refs
(Contract F33600-79-C-0549; DARPA Order 2551)
(AD-A095872; SDAC-TR-80-2) Avail: NTIS HC A04/MF A01 CSCL 17/10

This survey reveals that the five functioning automatic association programs existing today in the world, even though they were developed separately in independent institutions, all operate according to the same general schema. Different algorithms and strategies do appear in the event refinement process, and seem to use as much of the attributes of the data as possible to exclude misassociations and false alarms. Recommendations are made for the SDAC AA and ADAPS to use as many of these algorithms as can be supported by the data. GRA

N81-21665*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ESCAPING NONTHERMAL CONTINUUM RADIATION Progress Report
W. S. Kurth, D. A. Gurnett, and R. R. Anderson Nov. 1980 64 p refs Submitted for publication
(Contract NAS5-20093; Grants NGL-16-001-002; NGL-16-001-043; Contract N00014-76-C-0016)
(NASA-CR-164227; AD-A096322; U-of-IOWA-80-42) Avail: NTIS HC A04/MF A01 CSCL 04/1

New observations by the ISEE 1 plasma wave receiver reveal heretofore unreported details of the nonthermal continuum

radiation from the Earth. In particular, the higher frequency escaping component shows temporal and spectral features which are quite different from those of the lower frequency trapped emission. The higher frequency component is often clearly separated in frequency from the trapped component and high resolution spectrograms show that the escaping radiation consists of numerous narrowband emissions which drift slowly in frequency with time. The higher frequency component also exhibits greater temporal and spatial variability in both amplitude and frequency although the temporal variations are still quite smooth when compared to the more intense and higher frequency auroral kilometric radiation. Evidence is presented which clearly shows a direct connection between intense electrostatic emissions near the upper hybrid frequency and the escaping continuum radiation and strongly suggests the latter electromagnetic emission is generated through mode coupling with the upper hybrid waves. The new ISEE observations of the escaping continuum radiation from the Earth strongly suggest a close correspondence with the newly reported narrowband kilometric radiation from Jupiter. Both emissions are relatively narrowband and show slow variations in amplitude with time. In both cases, the narrowband radiation lies above the trapped continuum radiation and below the intense extraordinary mode emissions (auroral kilometric radiation at the Earth and decametric radiation at Jupiter. GRA

N81-21666*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

THE KILOMETRIC RADIO EMISSION SPECTRUM: RELATIONSHIP TO AURORAL ACCELERATION PROCESSES Progress Report

D. A. Gurnett and R. R. Anderson 31 Jan. 1981 38 p refs Presented at the Chapman Conf. on the Foundation of Auroral Arcs, Fairbanks, Alaska, 21 Jul. 1980 Submitted for publication

(Contract NAS5-20093; Grants NGL-16-001-043; NGL-16-001-002; Contract N00014-76-C-0016; (NASA-CR-164228; AD-A096320; U-of-Iowa-81-4) Avail: NTIS HC A03/MF A01 CSCL 20/14

Satellite measurements have now confirmed that intense radio emissions called auroral kilometric radiation are generated at altitudes of 2 to 3 RE over the auroral regions. These radio emissions are believed to be generated by Doppler-shifted cyclotron radiation from the electrons involved in the auroral acceleration process. Using current theories for the generation of this radiation, we discuss the possibilities for obtaining information on the auroral acceleration processes from the spectrum of this radiation. For example, under certain conditions it is shown that the low frequency cutoff provides a direct indication of the upper altitude limit of the acceleration region. Also, certain drifting features in the spectrum can be interpreted in terms of the propagation of shock-like disturbances along the auroral field lines at velocities near the ion-acoustic speed. GRA

N81-21667# Rondout Associates, Inc., Stone Ridge, N.Y.

REGIONAL SEISMIC WAVE PROPAGATION Semiannual Technical Report, 1 Jan. - 30 Jun. 1980

Thomas C. Chen and Paul W. Pomeroy 31 Jul. 1980 61 p refs

(Contract F49620-78-C-0043; ARPA Order 3291; AF Proj. 3291)

(AD-A095851; Rept-03-80-2; AFOSR-81-0190TR; STR-5) Avail: NTIS HC A04/MF A01 CSCL 08/11

In a review of studies on the seismic phase Lg, we describe its particle motion, dispersion, spectral content, mode of propagation, and magnitude-scale; we also tabulate the regional velocity, attenuation, and propagation efficiency for this seismic phase. The characteristics of Lg-wave propagation in the eastern United states are compared with those in different regions of the Soviet Union. Possible discriminants such as Lg VS. Pamplitudes, Lg/ P amplitude ratios as a function of distance, and Lg energy ratios are found, similar to attenuation and group velocity, to be highly dependent on the propagation path. The valid application of these quantities to the problem of earthquake-explosion discrimination will therefor require regional studies more detailed than previously assumed. A re-evaluation of the magnitude yield relation and an examination of physical parameters which may be relevant to the estimated yield of underground nuclear explosions were performed. The preliminary results indicate that the sub M sub b vs. yield relation shows regional differences and dependence on the source medium, and the collapse volume and the diameter of the collapsed crater are usually proportional to the estimated yield. GRA

N81-21668# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

PREPARATION OF MONTHLY MAPS OF SOLAR AVAILABILITY FOR NEW MEXICO BASED ON SATELLITE PHOTOGRAPHY Technical Completion Report, 1 Feb. 1979 - 30 Sep. 1979

R. J. Bahm Jan. 1981 29 p refs Sponsored by New Mexico Energy and Minerals Dept. and New Mexico Energy Inst.

(EMD-78-2131) Avail: NTIS HC A03/MF A01

A set of 12 maps, one for each month, of solar radiation availability over the state of New Mexico is presented. The results indicate that long term solar radiation availability actually varies little over the state and that long term values for Albuquerque may be used over the entire state for most solar space heating design purposes. T.M.

N81-21669# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Seismology.

US EARTHQUAKE OBSERVATORIES: RECOMMENDATIONS FOR A NEW NATIONAL NETWORK

1980 136 p refs

(Contract DE-AT02-76CH-93003)

(DOE/CH-93003-5; ISBN-0-309-03131-1; LC-80-84820) Avail: NTIS HC A07/MF A01

The central recommendation of the Panel is that the guiding concept be established of a rotationalized and integrated seismograph system consisting of regional seismograph networks run for crucial regional research and monitoring purposes in tandem with a carefully designed, but sparser, nationwide network of technologically advanced observatories. Such a national system must be thought of not only in terms of instrumentation but equally in terms of data storage, computer processing, and record availability. DOE

N81-21670# New York State Dept. of Health, Albany. Div. of Labs. and Research.

STRATOSPHERIC OZONE IN THE PLANETARY BOUNDARY LAYER

V. A. Dutkiewicz, L. Husain, and A. Rusheed 1980 8 p refs Presented at the Quadrennial Intern. Ozone Symp., Boulder, Colo., 4 Aug. 1980

(Contract DE-AS02-77EV-04501)

(CONF-800869-5) Avail: NTIS HC A02/MF A01

The impact of stratospheric ozone associated with rapid transport processes at Whiteface Mountain, New York was studied using (7)Be as a stratospheric tracer. The seasonal variation of (7)Be concentration suggests that the greatest impact of stratospheric ozone at Whiteface Mountain occurs during late spring and early summer consistent with the time when the impact of tropopause folding should be maximum. This is also the time when tropospheric photochemical ozone production is likely to be maximum. The average SO42(+) concentration peaked a day after (7)Be suggesting the backside of the weather system responsible for rapid subsidence also favors transport to this site from distant urban-industrial centers. Photochemical pollution episodes may be intensified by stratospheric subsidence. DOE

N81-21671# California Univ., Livermore. Lawrence Livermore Lab.

RELATIVE EFFICIENCY OF A NUMBER OF HALOCARBONS FOR DESTROYING STRATOSPHERIC OZONE

Donald J. Wuebbles Jan. 1981 12 p refs

(Contract W-7405-eng-48)

(UCID-18924) Avail: NTIS HC A02/MF A01

The possible depletion of the stratospheric ozone layer could have significant biological and agricultural impacts because of the sensitivity of living organisms to the increased ultraviolet irradiation that would accompany a decrease in the stratospheric ozone shield. The LLNL one dimensional transport kinetics model of the troposphere and stratosphere was used to examine the relative efficiency of a number of compounds for potentially reducing stratospheric ozone concentrations. DOE

N81-21672# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.

AIR PRESSURE WAVES FROM MT. ST. HELENS ERUPTIONS

Jack W. Reed 1980 24 p refs
(SAND-80-1970; CONF-801234-1) Avail: NTIS HC A02/MF A01

Barograms were assembled for the May 18, 1980 eruption and compared to airblast wave propagations from large explosions. Wave amplitudes at 50 to 300 km distances were what might be expected from a nuclear explosion of between 1 megaton and 10 megaton yield. Pressure time signatures could not be received for the first compression phase, because of the slow paper recording speed. The 900 s negative phase duration was too long for comparison with the negative phase of an explosion. Nevertheless, positive and negative amplitudes were about equal, as often observed at long distances from explosions. Calculations made for a simple finite amplitude propagation model show rough bounds on the source compression rate, to give the observed inaudible waves at least to 54 km distance, yet cause audibly rapid compression at Seattle, near 150 km, and beyond. S.F.

N81-21673# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

INVESTIGATIONS INTO ELLIPTIC AND MIXED BOUNDARY VALUE PROBLEMS IN GEODESY Ph.D. Thesis - Bonn Univ. [UNTERSUCHUNGEN ZU SCHIEFACHSIGEN UND GEMISCHTEN RANDWERTAUFGABEN DER GEODAESIE]

Wolfgang Bosch 1979 105 p refs In GERMAN
(Ser-C-258; ISBN-3-7696-9310-8; ISSN-0065-5325) Avail: NTIS HC A06/MF A01

The transformation of elliptic boundary value problems into singular integral equations is considered, and a nonclassical formulation of the geodetic boundary value problem is presented. The transformation leads to an n-dimensional singular equation with a closed solution by Giraud theory. A Fredholm alternative is derived, and an elliptic boundary value corollary to potential theory is proven. Results are applied to the determination of the ocean surface slope, given altimeter measurements. The gravitational potential is taken as an harmonic function and the boundary value is given in terms of a Green formalism.
Author (ESA)

N81-21674# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.

PRELIMINARY RESEARCH FOR THE MEASUREMENT OF THE INTERPLANETARY MAGNETIC FIELDS AND CERTAIN PARAMETERS OF THE IONOSPHERE [VORUNTERSUCHUNGEN FUER DIE MESSUNG DES INTERPLANETAREN MAGNETFELDES UND GEWISSER PARAMETER DER IONOSPHAERE]

R. Schmidt, W. Riedler, M. Friedrich, E. Ofner, W. Ramsauer, K. Schwingenschuh, K. M. Torkar, and N. Valavanoglou Jul. 1979 84 p refs In GERMAN
(INW-7910) Avail: NTIS HC A05/MF A01

The onboard processing of data from a Fluxgate magnetometer for an interplanetary probe is considered. A Faraday rotation simulation program is described, and experiments with rocketborne measuring apparatus are discussed. The magnetometer functions, Fourier data transformation, and bubble memory capacity are covered, including clean room assembly. The data processor is presented, detailing normal operation and test mode, data sampling, processing, and the interface with the onboard computer. The use digital filters is treated. The Faraday simulation program is broken down into subroutines which are explained, Simulation results and the numerical computation of impedance probe measurements are reported. Author (ESA)

N81-21675# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

CORRELATED WAVE AND PARTICLE OBSERVATIONS UPSTREAM OF THE EARTH'S BOW SHOCK

C. C. Harvey, M. B. Bavassano-Cattaneo (CNR, Frascati, Italy), M. Dobrowolny (CNR, Frascati, Italy), S. Orisni (CNR, Frascati, Italy), A. Mangeney (Observatoire de Paris), and C. T. Russell (California Univ., Los Angeles) Aug. 1980 49 p refs Submitted for publication
(LPS-80-12) Avail: NTIS HC A03/MF A01

Data from three International Sun Earth Explorer experiments during several periods of turbulence observed in the solar wind upstream of the Earth's quasi parallel bow shock were analyzed. Radio observations are used to validate a shock model, used to compute various geometrical parameters for the periods studied. It is shown that the radio noise spectrum has two components, one centered around the local electron plasma frequency and the other at somewhat lower frequencies. The latter component has a shorter wavelength and correlates with the level of (MHD) magnetohydrodynamic turbulence. A multivariate canonical analysis of particle and MHD data shows that the proton anisotropy and turbulence level correlate well with the minimum backstreaming proton parallel velocity. Trivariate analysis shows that the correlation of particles and turbulence with the angle between the magnetic field and the shock normal have their sense reversed. Good correlation is found between power and compressibility in magnetic fluctuations. Author (ESA)

N81-21676# Kiruna Geophysical Inst. (Sweden).

MULTI-METHOD OBSERVATIONS AND MODELING OF THE THREE DIMENSIONAL CURRENTS ASSOCIATED WITH A VERY STRONG PS6 EVENT

G. Gustafsson, W. Baumjohann (Muenster Univ., West Germany), and I. Iverson (Danish Space Research Inst.) May 1980 28 p refs Submitted for publication Sponsored in part by Deutsche Forschungsgemeinschaft (DFG)
(KGI-80-2; ISSN-0349-2656) Avail: NTIS HC A03/MF A01

A pulsation event was studied that showed characteristics of the Ps 6 type with a period of about 20 min. Data from a number of magnetometer and riometer measurements over a large area were combined with balloon measurements of the electric field to obtain a detailed description of the ionospheric current system during the event. The pulsations occurred over a period longer than 3 hours and showed large magnetic variations, up to 700 nT. A model of the real three dimensional current flow is derived that agrees with the data. Hall currents are held to be the cause of the magnetic disturbances on the ground.
Author (ESA)

N81-21677# Tuebingen Univ. (West Germany). Astronomisches Inst.

HORIZONTAL COMPONENTS OF THE ATMOSPHERIC ELECTRIC FIELD. STUDIES OF THE ATMOSPHERIC ELECTRIC FIELD IN VIEW OF ELECTROSTATICALLY CONTROLLED AUTOMATIC PILOT APPLICATIONS [HORIZONTALKOMPONENTEN DES LUFTELEKTRISCHEN FELDES. UNTERSUCHUNGEN DER LUFTELEKTRISCHEN VORAUSSETZUNGEN FUER DEN EINSATZ ELEKTROSTATISCHER AUTOPILOTEN]

H.-J. Fischer and J. Leidel Bonn Bundesmin. des Verteidigung 1980 140 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. des Verteidigung
(BMVg-FBWT-80-7) Avail: NTIS HC A07/MF A01

The feasability of using the natural atmospheric electric fields to achieve stabilization was studied. For such applications the electric vector should be vertical or nearly vertical. Investigations into the frequency and magnitude of horizontal components were studied over several typical regions of Germany. Industrialized and heavily populated areas strongly disturbed stabilization conditions. The effects of long term variations and local perturbations such as high buildings are discussed. The latter can be avoided by flying around them. Author (ESA)

N81-21678# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).

ENERGY SPECTRA OF INCIDENT ELECTRONS FROM AURORAL IONIZATION PROFILES

E. Barouch Sep. 1980 26 p refs
(CRPE-NT-87) Avail: NTIS HC A03/MF A01

The production of ionospheric ionization at night by auroral electrons and its height dependence are discussed. It is found that the altitude dependence of the effective recombination coefficient alpha sub e of the ions involved is of great importance in determining the ionization profile produced by a given incident electron spectrum. Empirical formulas are proposed for evaluating alpha sub e as a function of height when the temperature profile is known and when it is unknown. Electron intensity profiles obtained in the auroral zone at night are examined for several

nights during conditions of diffuse aurora. The incident electron spectra are computed from these measurements. Author (ESA)

N81-21679# Ohio State Univ., Columbus.
APPLICATION OF FOURIER TRANSFORM SPECTROSCOPY TO AIR POLLUTION PROBLEMS Final Report, 15 Jul. 1975 - 31 Jul. 1979
John H. Shaw and Jack G. Calvert Nov. 1980 140 p refs (Grant EPA-R-803868)
(PB81-120792; EPA-600/3-80-093) Avail: NTIS HC A07/MF A01 CSCL 04A

The nature of information that can be retrieved from spectra obtained with Fourier transform spectroscopy is discussed. Nonlinear, least squares analysis of spectra is capable of retrieving information that is beyond the reach of conventional methods and has improved precision and accuracy. Fourier transform infrared spectroscopy was used to study quantitatively the kinetics and mechanisms of several chemical reactions that are of interest to atmospheric chemists and are important in the development of air pollution control strategies. The systems studied include the metastable, reactive, gaseous species, peroxynitric acid, hypochlorous acid, and dimethylnitrosamine. GRA

N81-21680# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
THE ELECTRICAL CONDUCTIVITY OF THE ENVIRONMENT IN RURAL BOULDER COUNTY, COLORADO, FOR THE YEARS 1967 - 1980: AN INDICATION OF DETERIORATING AIR QUALITY
William E. Cobb Sep. 1980 29 p refs
(PB81-132813; NOAA-TM-ERL-ARL-89; NOAA-80110404) Avail: NTIS HC A03/MF A01 CSCL 04A

The origin of the electrical conductivity of the atmosphere and the inverse correlation between the conductivity and the atmospheric burden of suspended particulates is discussed. A 13 year decline in the conductivity monitored in rural Boulder County, Colorado, is presented as evidence of a secular increase in particulate pollution since 1967 and a degradation of the regional air quality. GRA

N81-21681# National Academy of Sciences - National Research Council, Washington, D. C.
DIRECTORY OF WORLD SEISMOGRAPH STATIONS. VOLUME 1: THE AMERICANS-PART 1: STATES, CANADA AND BERMUDA
Barbara B. Poppe Oct. 1980 471 p refs Sponsored by NAS-NRC, Washington, D.C.
(PB81-140949; SE-25) Avail: NTIS HC A20/MF A01 CSCL 08K

A compilation of detailed information about seismograph stations in the United States, Canada, and Bermuda current to June 1977 (Canada to mid-1979) is presented alphabetically by State or Province and then by operating institution. Availability of records is indicated. A listing of response curves for instrument systems that are broadly used, a cross reference of stations in alphabetic order, region maps of the stations coded by the National Earthquake Information Service are included. GRA

N81-21682# National Academy of Sciences - National Research Council, Washington, D. C. World Data Center A for Solid Earth Geophysics.
HISTORICAL SEISMOGRAM FILMING PROJECT Progress Report
Dale P. Glover Aug. 1980 67 p refs
(PB81-141517; SE-24; NOAA-80111402; PR-2) Avail: NTIS HC A04/MF A01 CSCL 08K

Over 120,000 seismograms were filmed during the first year of the Historical Seismogram Filming Project. The emphasis was on U.S. stations of the Federal network through the year 1955. During the remainder of 1980 the emphasis will continue to be on filming of these stations through 1963. Filming other non-Federal U.S. stations and arranging for the filming of foreign stations will also be done. GRA

N81-21683# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
DYNAMIC SOIL-STRUCTURE INTERACTION Ph.D. Thesis
Kuen-Yaw Shye and Arthur R. Robinson Sep. 1980 113 p refs
(Grants NSF ENV-77-07190; NSF PFR-80-02582)
(PB81-144503; UILU-ENG-80-2018; Structural Research SER-484; NSF/RA-800305) Avail: NTIS HC A06/MF A01 CSCL 08K

A method for a simple extension of response spectrum procedures in seismic building analysis to include dynamic soil structure interaction is provided. The analysis utilizes soil impedance functions for a structural foundation. Most of the computational results refer to a rigid mat foundation. The damping that arises in a soil structure system will generally be nonclassical. A rapid approximate scheme was developed for computing nonclassical modes of a soil structure system. The computation, which is extremely effective, uses a classical mode of the structure with its base fixed. The differences of the initial and improved modes give direct measures of the significance of the interaction effects. GRA

N81-21688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MIDDLE ATMOSPHERE RESPONSE TO MEASURED RELATIVISTIC ELECTRONS
J. R. Barcus, R. A. Goldberg, E. R. Hilsenrath (Texas Univ., El Pasa), and J. D. Mitchell *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978-1979, Vol. 1 Mar. 1981 p 243 refs Presented at the Intern. Union of Geodesy and Geophys. (IUGG) Proc., Middle Atmosphere Symp., Canberra, Australia, Dec. 1979 (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 04A

N81-21690*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISONS OF GLOBAL OZONE TRENDS INFERRED FROM THE BUV EXPERIMENT ON NIMBUS 4 AND THE GROUND-BASED NETWORK
D. F. Heath *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 Mar. 1981 p 279 Repr. from (COSPAR) Remote Sounding of the Atmosphere from Space (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-21684# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE GIANINI CAMERA: A SHORT FOCAL LENGTH INSTRUMENT FOR ACCURATELY DETERMINING THERMOSPHERE WINDS. AERONOMICA ACTA A - NO. 220, 1980 [LA CAMERA GIANINI: UN INSTRUMENT A COURTE DISTANCE FOCALE QUALIFIE POUR LA DETERMINATION PRECISE DES VENTS THERMOSPHERIQUES. AERONOMIC ACTA A - NO. 220, 1980]
E. vanHemelrijck 1980 25 p refs In FRENCH; ENGLISH summary Submitted for publication
(Aeronomica-Acta-A-220-1980) Avail: NTIS Avail: Issuing Activity

The results of measurements made with Gianini cameras at two different sites are given. These cameras are equipped with a 77 mm focal length Super Faron lens (f number 0.87) and 36 mm Kodak 2485 film. The field of view is 18 x 26 deg. They are supplied with an equatorial frame fixed on an aluminum support sealed in a concrete base. Extremely high accuracies are obtained for artificial cloud altitudes (40 + or - 10 m) and wind speeds (1 m/sec) for time intervals ranging from 30 to 50 sec between two successive cloud position determinations. Some results on the dynamical behavior of the lower thermosphere are also discussed. Author (ESA)

N81-21685*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF ATMOSPHERIC OZONE LEVELS AT COMMERCIAL AIRPLANE CRUISE ALTITUDES IN WINTER AND SPRING, 1976 - 1977

James D. Holdeman and Gregory D. Nastrom (Control Data Corp., Minneapolis) Apr. 1981 18 p refs
(Contract DOT-FA78WAI-893)
(NASA-TP-1807; FAA-EE-81-1; E-468) Avail: NTIS HC A02/MF A01 CSCL 04B

It was speculated that the ozone sickness experienced by some airline passengers and crew members during the winter and spring of 1976-77 were induced by abnormally high concentrations of ambient atmospheric ozone. To investigate the possibility that 1976-77 was anomalous, ozone measurements from balloons for up to 13 years and from Global Atmospheric Sampling Program (GASP) equipped aircraft for 3 years were studied. The analyses presented show that the winter and spring seasons of 1976-77 were averaged statistically, and no evidence was found to suggest that there was more than a usual variation in the frequency that commercial airplanes encountered high ambient ozone concentrations. Author

N81-21686*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD LABORATORY FOR ATMOSPHERIC SCIENCE, COLLECTED REPRINTS 1978-1979, VOLUME 1
William C. Skillman, ed. and Earl R. Kreins, ed. Mar. 1981 565 p refs
(NASA-TP-1788-Vol-1) Avail: NTIS HC A24/MF A01 CSCL 04B

A ready reference is presented to 61 papers by members of the Laboratory published between January 1, 1978 and December 31, 1979. To avoid unnecessary duplication, only abstracts or introductions of NASA reports and conference proceedings are included with reprints of articles from various journals. For individual titles, see N81-21687 through N81-21692.

N81-21687*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME EXPERIMENTS ON THE EFFECT OF REMOTE SOUNDING TEMPERATURES UPON WEATHER FORECASTING
M. Halem, M. Ghil (New York Univ., New York), and R. Atlas (State Univ. of New York at Stony Brook) *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 Mar. 1981 p 175-199 refs Repr. from Remote Sensing of the Atmosphere: Inversion Methods and Appl. (Amsterdam), 1978 (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 04B

A time-continuous statistical method is presented for the four dimensional assimilation of remote sounding temperatures based on radiance measurements from polar orbiting satellites. This method is applied to DST 6 data from the NOAA 4 and Nimbus 6 satellites. The state of the atmosphere throughout the test period was determined using a varying amount of satellite data from the NOAA 4 satellite only, from Nimbus 6 only, and from both satellites together. The methods tested included different variations of the statistical method, as well as more traditional methods. It is concluded that satellite derived temperature data can have a modest, but statistically significant positive impact on numerical weather prediction in the two to three day range, and that this impact is highly sensitive to the quantity of data available and to the assimilation method used. A.R.H.

N81-21688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MIDDLE ATMOSPHERE RESPONSE TO MEASURED RELATIVISTIC ELECTRONS **c46**
J. R. Barcus, R. A. Goldberg, E. R. Hilsenrath (Texas Univ., El Pasa), and J. D. Mitchell *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978-1979, Vol. 1 Mar. 1981 p 243 refs Presented at the Intern. Union of Geodesy and Geophys. (IUGG) Proc., Middle Atmosphere Symp., Canberra, Australia, Dec. 1979 (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 04A

During two independent rocket programs, Aurorozone 1 and 2 at Poker Flat Research Range, Alaska in September 1976 and March 1978 respectively, frequent penetration and absorption of relativistic electrons were observed between 40-70 km altitude. This relativistic electron source was compared with bremsstrahlung X-ray energy deposition in the same altitude domain. Correlated atmospheric electrical response was simultaneously observed. Ozone was also measured following each event to determine its departure from quiet nighttime values. Preliminary results for Aurorozone 1 show that the relativistic electrons observed on September 23, 1976 dominated X-ray bremstrahlung as an energy source to an atmospheric depth of 55 km. Above this height, the deposition ratio rapidly grew to a value greater than 100, clearly demonstrating the dominant role of relativistic electrons as an important energy source for this lower mesospheric domain. A.R.H.

N81-21689*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AURORAL X-RAY DETECTION FROM ROCKET OVERFLIGHTS **c43**
A. Goldberg, J. R. Barcus, L. H. Gesell (Computer Sciences Corp., Silver Spring, Md.), and R. R. Vondrak (SRI International, Menlo Park, Calif.) *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 Mar. 1981 p 268 Presented at the Intern. Union of Geodesy and Geophys. (IUGG) Proc., Middle Atmosphere Symp., Canberra, Australia, Dec. 1979 (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 03B

Remote sensing of auroral X-rays from the topside can provide both local and global information concerning X-ray and energetic particle deposition within the middle atmosphere. Usually, contamination of X-ray detectors by corpuscular radiation can severely affect the scope and accuracy of the measurement. Preliminary results obtained with a rocket-borne instrument designed to operate cleanly in a precipitating particle environment are reported. Two dimensional images of the atmospheric bremsstrahlung X-ray sources were also constructed from the detector scan produced by payload translation and coning. A.R.H.

N81-21690*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISONS OF GLOBAL OZONE TRENDS INFERRED FROM THE BUV EXPERIMENT ON NIMBUS 4 AND THE GROUND-BASED NETWORK **c46**
D. F. Heath *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 Mar. 1981 p 279 Repr. from (COSPAR) Remote Sounding of the Atmosphere from Space (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 04A

Preliminary comparisons between global ozone burdens derived from the backscattered ultraviolet (BUV) experiment on Nimbus 4 and those inferred from an analysis of ground-based network data seem to indicate significant differences in the inter-annual variability of ozone. Some of the observed differences may be due to improper weighting of the ground-based network data, slowly changing planetary wave structure over the fixed station, of small inter-annual changes in meridional transport parameters. There is also some evidence which indicates that the polar stratosphere at high latitudes may represent an important ozone storage resevoir which tends to compensate for large scale changes observed in the regions outside of the polar stratosphere. Possible consequences of this are that the global trends derived from ground based ozone measurements may not be valid and furthermore that the current satellite techniques by themselves may be sufficient. An ozone monitoring system which includes observations from satellites, ground-based stations, balloons and rockets may be necessary. A.R.H.

N81-21691*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF SEVERE THUNDERSTORMS USING SHORT INTERVAL GEOSYNCHRONOUS SATELLITE DATA
Robert F. Adler and Douglas D. Fenn (GE/MATSCO, Beltsville, Md.) *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 Mar. 1981 p 341-346 refs Repr. from Preprint Vol: Eleventh Conf. on Severe Local Storms Conf. held Kansas City, Mo., 2-5 Oct. 1979 (For primary document see N81-21686 12-47)
Avail: NTIS HC A24/MF A01 CSCL 04B

The potential and limitations of using short interval (3-7 minutes) geosynchronous, infrared data to ascertain thunderstorm intensity, and therefore indirectly detect severe

thunderstorms are discussed. Thunderstorms on four case study days were analyzed over selected areas and time periods using SMS/GOES data, and derived satellite based intensity parameters were compared to severe weather reports. Young, growing thunderstorms are intensity rated using the rate of decrease of the satellite observed cloud top minimum equivalent blackbody temperature. Since most storms cannot be observed until they penetrate through the cirrus overcast produced by previous convection, minimum cloud temperature and rate of blackbody temperature isotherm expansion are then used as intensity indicators. Results are presented and problems and limitations of the techniques and the data are examined. In addition, an analysis of cloud top height variations (as viewed by the satellite) in relation to tornado touchdown times and, in a few cases, to mesocyclone formation times is also presented. A.R.H.

N81-21692*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TROPICAL CYCLONE RAINFALL CHARACTERISTICS AS DETERMINED FROM A SATELLITE PASSIVE MICROWAVE RADIOMETER
Edward B. Rodgers and Robert F. Adler *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints, 1978 - 1979, Vol. 1 1981 p 416 (For primary document see N81-21686 12-47)
(NASA-TM-80596) Avail: NTIS HC A24/MF A01 CSCL 04B

Data from the Nimbus 5 electrically scanning microwave radiometer (ESMR-5) were used to calculate latent heat release (LHR) and other rainfall parameters for over 70 satellite observations of 21 tropical cyclones during 1973, 1974, and 1975 in the tropical North Pacific Ocean. The results indicate that the ESMR-5 measurements can be useful in determining the rainfall characteristics of these storms and appear to be potentially useful in monitoring as well as predicting their intensity. The ESMR-5 derived total tropical cyclone rainfall estimates agree favorably with previous estimates for both the disturbance and typhoon stages. The mean typhoon rainfall rate (1.9 mm h/1) is approximately twice that of disturbances (1.1 mm h/1).
Author

N81-21693*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD LABORATORY FOR ATMOSPHERIC SCIENCES, COLLECTED REPRINTS 1978 - 1979, VOLUME 2
William C. Skillman and Earl R. Kreins Mar. 1981 521 p refs 2 Vol.
(NASA-TP-1788-Vol-2) Avail: NTIS HC A22/MF A01 CSCL 04B

Information about the Earth hydrosphere, obtained in the field and from aircraft and satellite imagery is reported. Particular emphasis is given to the use of microwave sensors in the study of soil moisture, sea ice, snow cover and atmospheric parameters associated with watersheds. For individual titles, see N81-21694 through N81-21701.

N81-21694*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1977 TUNDRA FIRE AT KOKOLIK RIVER, ALASKA
D. Hall, J. Brown, and L. Johnson *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1981 p 660-670 refs Repr. from U.S. Army Cold Regions Res. and Engr., SR-78-10, Aug. 1978 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

During the summer of 1977, fire totaled 44 sq km of tundra vegetation according to measurements using LANDSAT imagery. Based on the experience gained from analysis of this fire using ground observations, satellite imagery, and topographic maps, it appears that natural drainages form effective fire breaks on the subdued relief of the Arctic coastal plain and northern foothills. It is confirmed that the intensity of the fire is related to vegetation type and to the moisture content of the organic rich soils.
A.R.H.

N81-21695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1977 TUNDRA FIRE IN THE KOKOLIK RIVER AREA OF ALASKA
In its Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1981 p 671-675 refs Repr. from Arctic, J. of the Arctic Inst. of North Am., v. 31, no. 1, Mar. 1978 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

Presumably caused by lightning, a large fire occurred due east of Point Lay several kilometers southwest of the Kokolik River, the farthest north a fire was ever fought by Bufeau of Land Management personnel in Alaska. The progress and area extent of the fire were determined by analysis of LANDSAT MSS band 5 and 7 imagery. Low altitude observations from helicopter showed the fire burned a range of vegetation and relief types which included low polygonized and upland tussock tundras. The burned area appeared wetter on the surface than the unburned area, due to a lack of moisture absorbing organic matter and the possible release of moisture from the deeper thawed zone. Suggestions for future investigations of the effects of fire on tundra and permafrost terrains are discussed. A.R.H.

N81-21696*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROSPECTS FOR MEASURING PHYTOPLANKTON BLOOM EXTENT AND PATCHINESS USING REMOTELY SENSED COLOR IMAGES: AN EXAMPLE
James L. Mueller *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1981 p 680-685 refs Repr. from Toxic Dinoflagellate Blooms, Elsevier/North Holland, N.Y., 1979 p 303-308 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

A 10 channel scanning radiometer, built as a prototype for the coastal zone color scanner on the Nimbus 7 satellite, was flown on a high altitude aircraft during a Gymnodium breve bloom along the west coast of Florida. The remotely measured ocean color imagery shows what is probably the patchy structure of a G. breve bloom extending over a 60 km by 100 km area. This conclusion is based on visual inspection of bathymetry to infer bottom reflection trends and on a single growth truth measurement of B G. breve obtained the previous day. The image shows coherent blooms which extend scales up to 60 km in length. A.R.H.

N81-21697*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ARCTIC SEA ICE DECAY SIMULATED FOR A CO2-INDUCED TEMPERATURE RISE
Claire L. Parkinson and William W. Kellogg (National Center for Atmospheric Research) *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1981 p 687-700 refs Repr. from Climatic Change, v. 2, 1979 p 149-162 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

A large scale numerical time-dependent model of sea ice that takes into account the heat fluxes in and out of the ice, the seasonal occurrence of snow, and ice motions was used in an experiment to determine the response of the Arctic Ocean ice pack to a warming of the atmosphere. The degree of warming specified is that expected for a doubling of atmospheric carbon dioxide with its associated greenhouse effect, a condition that could occur before the middle of the next century. The results of three 5-year simulations with a warmer atmosphere and varied boundary conditions were: (1) that in the face of a 5 K surface atmospheric temperature increase the ice pack disappeared completely in August and September but reformed in the central Arctic Ocean in mid fall; (2) that the simulations were moderately dependence on assumptions concerning cloud cover; and (3) that even when atmospheric temperature increases of 6-9 K were combined with an order-of-magnitude increase in the upward heat flux from the ocean, the ice still appeared in winter. It should be noted that a year-round ice-free Arctic Ocean has apparently not existed for a million years or more. Author

N81-21698*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEASONAL AND DAILY SNOWMELT RUNOFF ESTIMATES UTILIZING SATELLITE DATA
In its Goddard Lab. for Atmospheric Sci. Collected Reprints 1978 - 1979, Vol. 2 Mar. 1980 p 742 refs Repr. from the

Specialty Conf. on Irrigation and Drainage in the Nineteen-Eighties, Albuquerque, N. Mex., 17-20 Jul. 1979 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

Methods using snowcovered area to update seasonal forecasts as snowmelt progresses are also being used in quasi-operational situations. The input of snowcovered area to snowmelt models for short term perdictions was attempted in two ways; namely, the modification of existing hydrologic models and/or the use of models that were specifically designed to use snowcovered area. A daily snowmelt runoff model was used with LANDSAT data to simulate discharge on remote basins in the Wind River Mountains of Wyoming. Daily predicted and actual flows compare closely, and, summarized over the entire snowmelt season (April 1 - September 30), the average difference is only three percent. The model and snowcovered area data are currently being tested on additional watersheds to determine the method's transferability. A.R.H.

N81-21699*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE UTILIZATION OF SPACEBORNE MICROWAVE RADIOMETERS FOR MONITORING SNOWPACK PROPERTIES
A. Rango, A. T. C. Chang, and J. L. Foster *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1980 p 745-760 refs Repr. from Nordic Hydrol., v. 10, 1979 p 25-40 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

Snow accumulation and depletion at specific locations can be monitored from space by observing related variations in microwave brightness temperatures. Using vertically and horizontally polarized brightness temperatures from the Nimbus 6 electrically scanning microwave radiometer, a discriminant function can be used to separate snow from no snow areas and map snowcovered area on a continental basis. For dry snow conditions on the Canadian high plains, significant relationships between snow depth or water equivalent and microwave brightness temperature were developed which could permit remote determination of these snow properties after acquisition of a wider range of data. The presence of melt water in the snowpack causes a marked increase in brightness temperature which can be used to predict snowpack priming and timing of runoff. As the resolutions of satellite microwave sensors improve the application of these results to snow hydrology problems should increase. Author

N81-21700*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF A SNOWMELT-RUNOFF MODEL USING LANDSAT DATA
In its Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1980 p 745-760 refs Repr. from Nordic Hydrol., vol. 10, 1979 p 225-238 (For primary document see N81-21693 12-47)
Avail: NTIS HC A22/MF A01 CSCL 04B

The snowmelt-runoff model developed for two small central European watersheds simulate daily streamflow on the 228 sq km Dinwoody Creek basin in Wyoming, using snowcover extent for LANDSAT and conventionally measured temperature and precipitation. For the six-month snowmelt seasons of 1976 and 1974, the simulated seasonal runoff volumes were within 5 and 1%, respectively, of the measured runoff. Also the daily fluctuations of discharge were simulated to a high degree by the model. Thus far the limiting basin size for applying the model has not been reached, and improvements can be expected if the hydrometeorological data can be obtained from a station inside the basin. LANDSAT provides an efficient way to obtain the critical snowcover input parameter required by the model. A.R.H.

N81-21701*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFERENCE OF THE BOUNDARY LAYER STRUCTURE OVER THE OCEANS FROM SATELLITE INFRARED MEASUREMENTS
C. Prabhakara, G. Dalu, R. Lo (Computer Sciences Corp., Silver Spring, Md.), and N. R. Nath (Computer Sciences Corp., Silver Spring, Md.) *In its* Goddard Lab. for Atmospheric Sci., Collected Reprints 1978 - 1979, Vol. 2 Mar. 1980 p 1042 refs Repr. from NASA-TM-79653, Sep. 1978 (For primary document see N81-21693 12-47)
(NASA-TM-79653) Avail: NTIS HC A22/MF A01 CSCL 04B

Remote infrared spectral measurements in the 8-13 micron m window region, at a resolution about 3 cm/1, contain useful information about the water vapor and temperature stratification of the atmosphere within the first few kilometers above the water surface. Two pieces of information are retrieved from the spectral measurements: precipitable water vapor in the atmosphere, from the depth of the line structure between 8 and 9 micron m due to water vapor lines; and sea surface temperature, from the variation of brightness temperature between 11 and 13 micron m. Together, these two pieces of information can signify either the presence of a deep moist convective layer or the prevalence of stable conditions, such as caused by temperature inversions, which inhibit moist convection. A simple infrared radiative transfer model of the 9 micron m water vapor lines was developed to validate the method. With the help of this model and the Nimbus 4 infrared interferometer spectrometer data, a gross picture of the planetary boundary layer for different seasons over the global oceans is deduced. The important regions of the trade wind inversion and the intertropical convergence zones over all the oceans are clearly identified with this method. The derived information is in reasonable agreement with some observed climatological patterns over the oceans. Author

N81-21702*# City Coll. of the City Univ. of New York.
DO INITIAL CONDITIONS MATTER? A COMPARISON OF MODEL CLIMATOLOGIES GENERATED FROM DIFFERENT INITIAL STATES
J. Spar, C. Cohen, and P. Wu Apr. 1981 29 p refs
(Grant NGR-33-016-086)
(NASA-TM-82326) Avail: NTIS HC A03/MF A01 CSCL 04B

A coarse mesh (8 by 10) 7 layer global climate model was used to compute 15 months of meteorological history in two perpetual January experiments on a water planet (without continents) with a zonally symmetric climatological January sea surface temperature field. In the first of the two water planet experiments the initial atmospheric state was a set of zonal mean values of specific humidity, temperature, and wind at each latitude. In the second experiment the model was initialized with globally uniform mean values of specific humidity and temperature on each sigma level surface, constant surface pressure (1010 mb), and zero wind everywhere. A comparison was made of the mean January climatic states generated by the two water planet experiments. The first two months of each 15 January run were discarded, and 13 month averages were computed from months 3 through 15. R.C.T.

N81-21703*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TOPICAL CYCLONE RAINFALL CHARACTERISTICS AS DETERMINED FROM A SATELLITE PASSIVE MICROWAVE RADIOMETER
E. B. Rodgers and R. F. Adler Dec. 1979 48 p refs
(NASA-TM-80596) Avail: NTIS HC A03/MF A01 CSCL 04B

Data from the Nimbus-5 Electrically Scanning Microwave Radiometer (ESMR-5) were used to calculate latent heat release and other rainfall parameters for over 70 satellite observations of 21 tropical cyclones in the tropical North Pacific Ocean. The results indicate that the ESMR-5 measurements can be useful in determining the rainfall characteristics of these storms and appear to be potentially useful in monitoring as well as predicting their intensity. The ESMR-5 derived total tropical cyclone rainfall estimates agree favorably with previous estimates for both the disturbance and typhoon stages. The mean typhoon rainfall rate (1.9 mm h(-1)) is approximately twice that of disturbances (1.1 mm h(-1)). M.G.

N81-21704*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
AMBIENT AMMONIA MEASUREMENTS USING LASER PHOTO-ACOUSTIC SPECTROSCOPY Final Report, period ending 19 Jun. 1981

Melville Dannehl Aldridge, III, Gary E. Copeland, and Charles N. Harward May 1981 117 p refs
(NASA-CR-164188) Avail: NTIS HC A06/MF A01 CSCL 04B

Ammonia concentrations reached minimal levels (approximately 0.1 ppb) in early winter, followed by a sudden later winter increase. A direct relationship between ambient ammonia levels and air temperature was inferred from the data (linear correlation coefficient $r=0.53$). Ammonia concentrations were determined to be directly related to the absolute humidity of the air ($r=0.72$); a weaker relationship between ammonia concentrations and relative humidity was discovered ($r=0.37$). The data also indicated that ammonia levels were generally higher within continental air masses than those of maritime origin. Soil parameters such as pH and moisture content were found to have a major bearing on the release of gaseous ammonia from soils in the region. T.M.

N81-21705# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Processing Div.
DOBBINS AFB, MARIETTA, GEORGIA, REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
12 Nov. 1980 457 p
(AD-A096181; AD-E850007; USAFETAC/DS-80/091) Avail: NTIS HC A20/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Dobbins AFB, Marietta, Georgia. It contains the following parts: (A) Weather conditions, Atmospheric Phenomena, (B) Precipitation; Snowfall and Snow Depth (daily amounts, and extreme values); (C) Surface winds; (D) Ceiling versus visibility, Sky cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (F) Pressure summary (Means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurring tables. GRA

N81-21706# Air Weather Service, Scott AFB, Ill.
THE USE OF THE SKEW T, LOG P DIAGRAM IN ANALYSIS AND FORECASTING
Dec. 1979 146 p
(AD-A096180; AD-E850018; AWS-TR-79-006) Avail: NTIS HC A07/MF A01 CSCL 04/2

This report describes the DoD Skew T, Log P Diagram and provides instructions on its use. These instructions include how to plot the data on the diagram and to determine unreported meteorological quantities and atmospheric stability from the data. Further instructions describe how to analyze discontinuities, stable layers, and clouds and how to use the plotted diagram to help forecast meteorological phenomena such as aircraft and icing and severe convective storms. GRA

N81-21707# Arinc Research Corp., Annapolis, Md.
FAILURE CRITICALITY ANALYSIS FOR TYPE B AND TYPE F WIND MEASURING AND INDICATING EQUIPMENT
Richard A. Coss Oct. 1980 49 p
(Contract N68335-79-C-2059)
(AD-A096392; Rept-1758-01-2-2360) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report presents the results of a failure criticality analysis performed for wind measuring and indicating equipment installed on Navy ships. GRA

N81-21708# Arinc Research Corp., Annapolis, Md.
DOCUMENTATION OF MAINTENANCE AND SUPPORT REQUIREMENTS FOR TYPE B AND TYPE F WIND MEASURING AND INDICATING EQUIPMENT Final Summary Report, 1 Oct. 1979 - 28 Oct. 1980
Richard A. Coss Oct. 1980 47 p
(Contract N68335-79-C-2059)
(AD-A096182; Rept-1758-01-3-2361) Avail: NTIS HC A03/MF A01 CSCL 04/2

All Navy ships are equipped with a wind measuring and indicating system that provides continuous visual indications of wind direction and speed as well as providing representative electrical signals for computation of flight deck crosswind and headwind conditions, computation of wind vectors for weapon launch systems, and record-keeping by meteorological equipment. Errors in indications of wind direction and speed, or complete loss of these signals can have serious safety consequences. Several accidents and near accidents involving aircraft have been, in part, attributed to problems associated with the wind measuring and indicating equipment. Many of the problems were reported to be the result of in-service maintenance and support deficiencies. In an attempt to minimize maintenance and support problems, NAEC is redefining and restructuring the maintenance concept so that in-service maintenance and support can be optimized. ARINC Research has assisted NAEC in this effort by conducting a program directed toward documenting maintenance and support requirements and identifying support problems associated with wind measuring and indicating equipment. GRA

N81-21709# Naval Postgraduate School, Monterey, Calif.
EVAPORATION DUCT OCCURRENCES IN THE NORTHEAST ATLANTIC DURING LATE SUMMER M.S. Thesis
Thomas Edwin Callaham Sep. 1980 106 p refs
(AD-A096363) Avail: NTIS HC A06/MF A01 CSCL 04/2

Analyses and interpretation of surface layer and synoptic-scale data obtained in the Northeast Atlantic were performed to obtain descriptions of the evaporation duct and associated atmospheric and oceanic synoptic features. The surface layer data were quite unique because they were obtained from high quality measurements from ships spatially separated in a fixed array. Magnitudes and horizontal homogeneity of duct heights were compared to air-mass trajectories and weather patterns. The mean duct height was 4-5m and higher values (8-13m) occurred with North and Northwest trajectories. During times when the heights were 8-13m, horizontal homogeneity occurred 35% of the time with a maximum duration of 12 hours. This was established on the basis of a two hundred kilometer separation between locations of duct height estimates. Significant features of the duct height and its temporal and spatial variations were related to synoptic scale descriptions. Satellite imagery used in conjunction with point observations appears to provide the most useful information in describing the intensity and areal distribution of the evaporation duct. GRA

N81-21710# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK, JANUARY 1981
Jan. 1981 241 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-81/01) Avail: NTIS HC A11/MF A01

Insolation, temperature, wind, and humidity data recorded during the month of January 1981, at the National Solar Data Network for residential and commercial building solar demonstration sites throughout the United States are presented. The insolation tables present the total, diffuse, direct, maximum, and extraterrestrial radiation. The temperature tables give the average, daytime, nighttime, maximum, minimum and inlet-water temperatures for the solar sites. Additional tables are presented for some of the sites, supplying either wind or relative humidity data, or both. These data are used to determine the thermal performance of the solar systems. DOE

N81-21711# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SPECTRAL ANALYSIS OF AMBIENT WEATHER PATTERNS
J. V. Anderson and K. Subbarao Jan. 1981 8 p refs Presented at the 3d Ann. Systems Simulation, Econ. Analysis/Solar Heating and Cooling Operational Results Conf., Reno, Nev., 27 Apr. - 1 May 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-721-960; CONF-810405-7) Avail: NTIS HC A02/MF A01

The analysis consisted of global and direct solar radiation, dry and wet bulb temperatures, and wind speed, was given. By analyzing the heating and cooling seasons independently, seasonal variations are isolated and a cleaner spectrum emerges. As a

demonstration of the efficiency of this method, synthetic data constructed with a small number of parameters was used in typical simulations, and the results were compared with those obtained with the original data. A spectral characterization of fluctuations around the moving average is given, and the changes in the fluctuation from season to season are examined. DOE

N81-21712# Nuclear Utility Services, Inc., Rockville, Md.
WIND ENERGY RESOURCE ATLAS. VOLUME 5: THE EAST CENTRAL REGION
R. Brode, R. Stoner, D. L. Elliott (Pacific Northwest Lab.), W. R. Barchet (Pacific Northwest Lab.), and R. L. George (Pacific Northwest Lab.) 1980 214 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3195-Vol-5) Avail: NTIS HC A10/MF A01

This atlas of the wind energy resource is composed of introductory and background information, a regional summary of the wind resource, and assessments of the wind resource in each state of the region. Background is presented on how the wind resource is assessed and on how the results of the assessment should be interpreted. A description of the wind resource on a regional scale is given. The results of the wind energy assessments for each state are assembled into an overview and summary of the various features of the regional wind energy resource. Assessments for individual states are presented. The state wind energy resources are described in greater detail than is the regional wind energy resource, and features of selected stations are discussed. States include Delaware, Maryland, Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. DOE

N81-21713# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
CLIMATIC FLUCTUATIONS, VOLCANIC AEROSOL AND CARBON DIOXIDE CHANGES Annual Progress Report, 1 Oct. 1979 - 30 Sep. 1980
Reginald E. Newell 21 May 1980 11 p refs
(Contract DE-AS02-76EV-12195)
(DOE/EV-12195-33) Avail: NTIS HC A02/MF A01

The relationship between tropospheric air temperature, sea surface temperature patterns and volcanic aerosol was derived by the application of generalized least squares analysis, which takes account of significant autocorrelation between the variables. Up to 50 percent of the variance of the tropical tropospheric air temperature is explained in terms of preceding values of the variables. The technique is applied to make a preliminary climatic forecast of the effect of the Mt. St. Helen's eruption of 18 May 1980 on zonal mean Northern Hemisphere temperature. A regression approach was used to forecast winter temperature over the continental U.S. using data base parameters. Techniques for experimental climatic forecasting are developed and studies of the background sea-air interaction processes are made. Surface effects extend up to at least 500 mb in the atmosphere. DOE

N81-21714# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.
A FAST RESPONSE PSYCHROMETER
W. Kohsiek and W. A. A. Monna 1980 37 p refs
(KNMI-WR-80-4) Avail: NTIS HC A03/MF A01

A fast response thermocouple psychrometer was built, and tested in a wind tunnel. The sensors, which are constructed from welded chromel alumel junctions of 50 micrometer diameter wire, are mounted vertically. The wick is a fine polyester thread covering the thermocouple wires over a length of about 20 mm. The wet junction is supplied with water by droplets falling along the wick with a frequency of about one per minute. At a wind speed of 4 m sec the response time of the wet bulb is 0.3 sec, that of the dry bulb is 0.05 sec. Error sources are examined. The effect of radiation is a few tenths of a degree Celsius for both bulbs. Author (ESA)

N81-21715# Fondazione Ugo Bordoni, Rome (Italy).
ANALYSIS OF THE SPATIAL DISTRIBUTION OF PRECIPITATION BASED ON RADIOELECTRIC AND METEOROLOGICAL DATA [INDAGINI SULLA STRUTTURA SPAZIALE DELLE PRECIPITAZIONI SULLA BASE DI DATTI RADIOELETTRICI E METEOROLOGICI]
Aldo Paraboni (Politecnico di Milan) Oct. 1980 44 p refs In ITALIAN
(FUB-20-1980) Avail: NTIS HC A03/MF A01

The use of electromagnetic attenuation data and pluviometric data for defining the propagation through rain of microwaves was examined. The interactions of both kinds of measurements, and some integrated prediction models are discussed. The modal theory of the probability distribution of point to point rain is discussed in particular. Relatively simple algorithms are used to make explicit the relationship between the physical description of rain and the electromagnetical description, which is the input for telecommunications engineering. Author (ESA)

N81-21716# European Space Agency, Paris (France).
THE PRECIPITATION ENHANCEMENT PROJECT (PEP)
Dieter Peffrath Jan. 1981 79 p refs Transl. into ENGLISH of 'Das Precipitation Enhancement Project (PEP)', DFVLR, Oberpfaffenhofen, West Germany Report DFVLR-Mitt-79-12, Sep. 1979 Presented at WMO Training Workshop on Weather Modification, Valladolid, Spain, 12-23 Mar. 1979 Original report in GERMAN previously announced as N80-26006
(ESA-TT-642; DFVLR-Mitt-79-12) Avail: NTIS HC A05/MF A01

The physics of clouds and precipitation, theories of weather modification, aircraft measuring systems, application of weather radar, microphysical measurements, condensation and ice nuclei, cloud seeding technology, hail suppression, and fog dispersal are addressed. The operational plan and measurement plan are summarized. Author (ESA)

N81-21717# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A COMPARISON OF HETERODYNE AND DIRECT DETECTION CO2 DIAL SYSTEMS FOR GROUND-BASED HUMIDITY PROFILING
R. M. Hardesty Oct. 1980 68 p refs
(PB81-141046; NOAA-TM-ERL-WPL-64; NOAA-80112801) Avail: NTIS HC A04/MF A01 CSCL 14B

A computer simulation developed to compare heterodyne and direct detection differential absorption lider (DIAL) performance for ground-based water vapor profiling includes atmospheric models for turbulence winds, wind shear, backscatter distribution, humidity and temperature and pressure uncertainties. Qualitative and quantitative causes of measurement error in differential absorption lidar systems are examined. Equations developed illustrate the relative sensitivity of the heterodyne system to speckle and turbulence. Heterodyne performance in a high signal to noise ratio regime was found to improve if transmit pulse duration was decreased. Both coherent and incoherent systems are degraded by insufficient knowledge of atmospheric properties such as temperature. GRA

N81-21718# National Climatic Center, Asheville, N. C.
HUMAN BIOMETEOROLOGY: A SELECTED BIBLIOGRAPHY
William T. Hodge and M. Lawrence Nicodemus Sep. 1980 46 p
(PB81-134512; NOAA-TM-EDIS-NCC-4; NOAA-80120308) Avail: NTIS HC A03/MF A01 CSCL 04B

A list of references which address topics relating climate and health parameters is provided. The references listed are generally from publications which are printed in the United States or which have been translated into English. Foreign publications are not generally included. The references are categorized according to Anatomical and Disorder topics and Associated topics. Some articles may not address climate and/or health directly, but are included because they may have some direct application to the subject. This reference list was compiled mainly from computerized data bases and from cursory review bibliographies and references cited in selected publications. GRA

N81-21719# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
THE BARROW, ALASKA AUTOMATIC CONDENSATION NUCLEI COUNTER AND FOUR WAVELENGTH NEPHELOMETER: INSTRUMENT DETAILS AND FOUR YEARS OF OBSERVATION
Mark E. Murphy and Barry A. Bodhaine Oct. 1980 105 p refs

(PB81-135196; NOAA-TR-ERL-ARL-90; NOAA-80112802)
Avail: NTIS HC A06/MF A01 CSCL 04B

These instruments provide a continuous aerosol climatology and identify periods of contamination. The G.E. counter data were calibrated from the G.E. Pollak data-pairs generated from the raw one-minute G.E. counter voltages. A linear least squares analysis was used to determine a best fit regression for 1976 data with the Pollak data as the independent variable and a multiplicative scaling factor for 1977 through 1979 generated from a histogram of G.E.-Pollak data ratios. Light scattering data show an annual cycle. Condensation nuclei data show a semiannual change with monthly means concentrations ranging between 50/CC and 1000/CC. Maxima are present in March and August, minima in June and September. GRA

N81-21720# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.

METLIB. A PROGRAM LIBRARY FOR CALCULATING AND PLOTTING MARINE BOUNDARY LAYER WIND FIELDS

J. E. Overland, R. A. Brown (Washington Univ., Seattle), and C. D. Mobley (Washington Univ., Seattle) Jun. 1980 86 p refs
(PB81-141038; NOAA-TM-ERL-PMEL-20; CONTRIB-451; NOAA-80111001) Avail: NTIS HC A05/MF A01 CSCL 04B

METLIB is a FORTRAN program library for deriving Earth-located time series of geostrophic, gradient, or surface winds from sea level pressure pressure and ancillary fields gridded on a polar stereographic projection. The library also contains programs for contouring scalars, such as SLP or wind speed, and for plotting vector arrows with a map background. A major advantage to the library is that spherical geometric calculations involving polar stereographic grids are internal to the programs. The relationship between gradient wind and surface wind can be assigned from speed reduction and turning angle constants or by a baroclinic, stability-dependent, single point boundary layer model. GRA

N81-21721# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.

SUMMARY OF GREAT LAKES WEATHER AND ICE CONDITIONS, WINTER 1978 - 1979

B. H. DeWitt, D. F. Kahlbaum, D. G. Baker, J. H. Wartha, F. A. Keys, D. E. Boyce, F. H. Quinn, R. A. Assel, A. Baker-Blocker, and K. M. Kurdziel Aug. 1980 135 p refs
(PB81-141053; NOAA-TM-ERL-GLERL-31; NOAA-80112803)
Avail: NTIS HC A07/MF A01 CSCL 04B

The winter of 1978-79 was the 16th coldest since 1779 and it was the third consecutive severe winter over the Great Lakes Region. During January and February 1979, the dominate upper air pressure pattern was such that the Great Lakes Region experienced a persistent northerly and northwesterly flow pattern. As a result, record low and near record low temperatures were recorded over the lakes during January and February. A unique feature of the 1978-79 winter season occurred on February 17 when all of the Great lakes were nearly 100% ice covered. February 17 was also the date when each of the Great Lakes reached their maximum ice cover. GRA

N81-21722# National Oceanic and Atmospheric Administration, Boulder, Colo. Prototype Regional Observing and Forecasting Service.

PROFS PROTOTYPE REGIONAL OBSERVING AND FORECASTING SERVICE PROPOSED POLICY, MISSION, GOALS, AND ORGANIZATIONAL STRUCTURE

D. W. Beran Jul. 1980 58 p
(PB81-141061; NOAA-TM-ERL-PROFS-2; NOAA-80110405)
Avail: NTIS HC A04/MF A01 CSCL 04B

A team of people each associated with a different aspect of focal weather service, was formed in March 1979 to help develop plans for PROPS (Prototype Regional Observing and Forecasting Service). The interdisciplinary team was drawn from four separate government agencies and the private sector. With representatives from both research and operational communities. A molding of ideas from this diverse group of people is presented and reports their findings, conclusions and recommendations on how to establish a program. GRA

N81-21723# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.

EVAPORATION FROM LAKE SUPERIOR

J. A. Derecki Jul. 1980 73 p refs
(PB81-141079; NOAA-TM-ERL-GLERL-29; NOAA-80110403)
Avail: NTIS HC A04/MF A01 CSCL 04B

Lake Superior monthly evaporation was determined for individual years of a 34 year period, 1942-75, by the water budget and mass transfer methods. Evaporation values determined by the two methods are in agreement, for the seasonal distribution and the annual total, with the resulting long term annual value of approximately 500 mm. Because of extensive ice cover, the overwater mass transfer results were adjusted for the effects of ice cover during winter. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-21724# Naval Postgraduate School, Monterey, Calif.

EXPERIMENTS IN WAVE RECORD ANALYSIS M.S. Thesis

Jose Luis Goncalves Cardoso Sep. 1980 140 p refs
(AD-A096353) Avail: NTIS HC A07/MF A01 CSCL 08/3

By examining the relationship of the individual waves in an ocean wave record and the power density spectrum (PDS), it is demonstrated that the PDS conventionally obtained using spectral analysis can be reasonably approximated, except at the very low frequency end, by a pseudo-power density spectrum constructed from the individual heights and periods contained in the record. The very low frequencies seen in the side bands of the PDS are examined as products of amplitude modulation by analogy with simulated wave records and as an indication of the presence of wave groups. In addition, wave groups are identified and their properties determined in 19 selected ocean wave records by integrating the wave record using the procedure of Funke and Mansard (1979). GRA

N81-21725# Hawaii Univ., Honolulu. Lab. of Oceanographic Engineering.

CURRENT-WAVE SPECTRA COUPLING PROJECT. VOLUME 3: CUMULATIVE DISTRIBUTION OF FORCES ON STRUCTURES SUBJECTED TO THE COMBINED ACTION OF CURRENTS AND RANDOM WAVES FOR POTENTIAL OTEC SITES: (A) KEAHOLD POINT, HAWAII, 100 YEAR HURRICANE; (B) PUNTA TUNA, PUERTO RICO, 100 YEAR HURRICANE; (C) NEW ORLEANS, LOUISIANA, 100 YEAR HURRICANE; (D) WEST COAST OF FLORIDA, 100 YEAR HURRICANE

Giulio Venezian, Charles L. Bretschneider, and Sridhar Jagannathan Aug. 1980 255 p refs 3 Vol.
(Contracts DE-AT02-76SF-20235; DE-AS03-76SF-00235)
(DOE/SF-20235/T1-Vol-3; Rept-80-1) Avail: NTIS HC A12/MF A01

The forces experienced by a structure at sea were analyzed statistically. The wave climate was described using a joint distribution of wave heights and periods (wave lengths), characterizing actual sea conditions through some measured or estimated parameters like the significant wave height, maximum spectral density, etc. Random wave heights and periods satisfying the joint distribution were then generated. A three parameter Longuet-Higgins type joint distribution of wave heights and periods is discussed and used to model sea conditions at four potential OTEC locations. A uniform cylindrical pipe of 3 m diameter, extending to a depth of 550 m served as a sample structure. Wave current interactions were included and forces computed using Morison's equation. The drag and virtual mass coefficients were interpolated from published data. A FORTRAN program CUFOR was written to execute the above procedure. Tabulated and graphic results of peak forces experienced by the structure, for each location, are presented. A listing of CUFOR is included. DOE

N81-21726# Skidaway Inst. of Oceanography, Savannah, Ga.

COORDINATION: SOUTHEAST CONTINENTAL SHELF STUDIES Progress Report

D. W. Menzel 1 Feb. 1981 31 p refs

(Contract DE-AS09-76EV-00901)
(DOE/EV-00901-5) Avail: NTIS HC A03/MF A01

Important physical, chemical, and biological processes which effect the transfer of materials on the southeast continental shelf were identified. Parameters which govern observed temporal and spatial variability on the continental shelf, and the extent and modes of coupling between events at the shelf break and nearshore were determined. The physical, chemical, and biological exchange rates on the inner shelf were also determined. T.M.

N81-21727# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
SIMULATIONS OF SURFACE TIDAL CURRENT CALCULATIONS FOR HF RADAR APPLICATIONS
R. S. Lyons and A. S. Frisch Aug. 1980 21 p refs
(PB81-133407; NOAA-TM-ERL-WPL-61; NOAA-80111004)
Avail: NTIS HC A02/MF A01 CSCL 08C

Coastal ocean dynamics applications radar (CODAR) data and possible data gaps were simulated to show the errors in mathematically recovered Fourier ideal coefficients when compared with the input coefficients. The modeled data consists of a Fourier series with three prominent tidal components of 12, 24, and 25.8 h, white noise with Gaussian distribution and a trend that simulates a storm surge and its recovery time. The baseline model showed that recovery of the 12 h component with less than 20 percent error is possible with only 1 day's data, and all three components can be recovered in 5 days with less than 20 percent error. This model was then applied to data gaps that occurred during field experiments. GRA

N81-21728# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
HF RADAR MEASUREMENTS OF SURFACE CURRENTS AT THE GEORGIA COAST, 9 TO 11 MAY 1978
M. M. Janopaul and B. L. Weber Aug. 1980 70 p refs
(PB81-141020; NOAA-TM-ERL-WPL-62; NOAA-80111005)
Avail: NTIS HC A04/MF A01 CSCL 08C

The study area includes the waters of the Savannah River Delta, Wassaw Sound, and the adjacent inner continental shelf. Hourly maps of instantaneous surface currents, tidal current ellipses, direct current averages, and simulated drift trajectories are presented. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-21729*# National Aeronautics and Space Administration, Washington, D. C.
SPACELAB FLIGHT SIMULATED BY TWO MONKEYS AT CERMA
Pierre Langereux Aug. 1980 6 p refs Transl. into ENGLISH from Air Cosmos (France), no. 803, 1 Mar. 1980 p 33 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76390) Avail: NTIS HC A02/MF A01 CSCL 06C

A semiautomatic module for two monkeys was designed. The module shelters two Rhesus monkeys seated side by side in a compartment, reducing the emotional stresses caused by isolation. Food pellets, water, and air are supplied and body wastes are automatically removed. Physiological and environmental parameters are continually monitored, making possible the performance of experiments concerning the pathophysiological mechanisms of the disorders of weightlessness. A ten day flight of the module in Spacelab was simulated. J.D.H.

N81-21730*# Alabama Univ., Birmingham. Lab. of Membrane Biology.
ELECTROPHORETIC CELL SEPARATION USING MICROSPHERES Final Report, 1 Oct. 1979 - 30 Sep. 1980
A. Smolka and G. Sachs 1980 65 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955534)
(NASA-CR-164168; JPL-9950-522) Avail: NTIS HC A04/MF A01 CSCL 06C

Methods of cell separation based on the electrokinetic properties of the cell membrane offer a degree of discrimination among cell populations which is not available with methods based on cell size or density alone. Studies aimed at extending red cell separations using microspheres to purification of lymphocytes. T.M.

N81-21731*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACTH-LIKE PEPTIDES INCREASE PAIN SENSITIVITY AND ANTAGONIZE OPIATE ANALGESIA
John P. Heybach and Joan Vernikos Mar. 1981 20 p refs
(NASA-TM-81254; A-8418) Avail: NTIS HC A02/MF A01 CSCL 06E

The role of the pituitary and of ACTH in pain sensitivity was investigated in the rat. Pain sensitivity was assessed by measuring paw-lick and jump latencies in response to being placed on a grid at 55 C. Hypophysectomy reduced pain sensitivity, and this effect was reversed by the intracerebroventricular (ICV) injection of the opiate antagonist naloxone. Similarly, the analgesia produced by a dose of morphine was antagonized by the administration of ACTH or alpha-MSH. The peripheral injection of ACTH or alpha-MSH in normal rats did not increase pain sensitivity. However, ACTH administered ICV increased pain sensivity within 10 min. The results indicate that the pituitary is the source of an endogenous opiate antagonist and hyperalgesic factor and that this factor is ACTH or an ACTH-like peptide. This activity resides in the N-terminal portion of the ACTH molecule since ACTH sub 4-10 is not active in this respect, nor does this activity require a free N-terminal serine since alpha-MSH appears to be almost as potent as the ACTH sub 1-24 peptide. It is concluded that ACTH-like peptides of pituitary origin act as endogenous hyperalgesic and opiate antagonistic factors. Author

N81-21732*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRESS ANTAGONIZES MORPHINE-INDUCED ANALGESIA IN RATS Final Report
Joan Vernikos, Lynn Shannon, and John P. Heybach Apr. 1981 18 p refs
(NASA-TM-81282; A-8505) Avail: NTIS HC A02/MF A01 CSCL 06C

Exposure to restraint stress resulted in antagonism of the analgesic effect of administered morphine in adult male rats. This antagonism of morphine-induced analgesia by restraint stress was not affected by adrenalectomy one day prior to testing, suggesting that stress-induced secretion of corticosteroids is not critical to this antagonism. In addition, parenteral administration of exogenous adrenocorticotropin (ACTH) mimicked the effect of stress in antagonizing morphine's analgesic efficacy. The hypothesis that ACTH is an endogenous opiate antagonist involved in modulating pain sensitivity is supported. Author

N81-21733# University of Eastern New Mexico, Portales.
EFFECTS OF LOW-LEVEL RADIATION ON BIOLOGIC SYSTEMS: A LITERATURE REVIEW
Troy L. Best, ed. and Barbara Hoditschek, ed. Dec. 1980 246 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7143) Avail: NTIS HC A11/MF A01

This review includes brief discussions of topics of particular interest, a listing of useful review articles, an extensive bibliography, and listings of sources that can be used to update this document in the future. The topics discussed include experimental studies, the linear hypothesis, medical effects, occupational effects, effects of exposure to naturally occurring radiation, consumer products, and laws and regulations. DOE

N81-21734# Rochester Univ., N. Y. Dept. of Radiation Biology and Biophysics.
BIOLOGIC RESPONSE TO MICROWAVE/RF ENERGY
Sol M. Michaelson 1980 4 p refs Presented at the 15th Ann. IMPI Symp. on Microwave Powers, Iowa City, 6 May 1980
(Contract DE-AC02-76EV-03490)
(UR-3490-1832; CONF-800501-2) Avail: NTIS HC A02/MF A01

A systematic and up to date review of observations and

theoretical approaches to the biological effects and health implications of exposure to microwave/radiofrequency energies is presented. A primary objective is to review and place available information and concepts in proper perspective to understand and encourage the full potential for the beneficial uses of these energies while at the same time preventing adverse effects to individuals exposed to microwaves/RF. DOE

N81-21735# *Joint Publications Research Service, Arlington, Va.* Foreign Broadcast Information Service.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 15, NO. 1

5 Mar. 1981 149 p refs Transl. into ENGLISH of Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1 Jan. - Feb. 1981 (JPRS-77513) Avail: NTIS HC A07/MF A01

Several articles are presented addressing various physiological and psychophysiological effects associated with space flight. Problems concerning life support, weightlessness, hypokinesia, and space flight feeding are addressed. For individual titles, see N81-21736 through N81-21758.

N81-21736# Joint Publications Research Service, Arlington, Va.

PHARMACOLOGICAL AGENTS FOR THE PREVENTION AND TREATMENT OF MOTION SICKNESS c52

V. S. Shashkov and V. V. Sabayev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 10-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 9-18 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Therapeutic and preventive agents for the various forms of motion sickness (MS) are overviewed. It is suggested that successful development of effective agents for the treatment of seasickness is only possible by means of wise combinations of drugs referable to different classes of chemical compounds. One should abandon the search of preventive agents among narcotics and tranquilizers. Dopaminergic substances, metabolites, and antimetabolites merit special attention, since a set of physiological and biochemical factors plays the leading role in the pathogenesis of MS, and their essence must be identified. In addition, it is suggested that attention should be concentrated on methodology and informativeness of methods used for quantitative evaluation of the efficacy of drugs in experiments on animals and studies involving man. M.G.

N81-21737# Joint Publications Research Service, Arlington, Va.

RESULTS OF STUDIES OF VESTIBULAR FUNCTION AND SPATIAL PERCEPTION IN THE CREWS OF THE FIRST AND SECOND EXPEDITIONS ABOARD SALYUT-6 STATION c53

I. Ya. Yakovleva, L. N. Kornilova, G. D. Syrykh, I. K. Tarasov, and V. N. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 25-30 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 19-23 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

The results of studies of the vestibular function and spatial perception function in the crew members of long term (96 and 140 day) space missions aboard Salyut 6 are presented. Similar changes and individual variations are revealed. All the cosmonauts showed the following changes: increased reactivity of the otolith organ, decreased sensitivity of the cupular system, asymmetry of most parameters studied, and illusory reactions in flight. Individual reactions are as follows: level of changes, dynamics and time of recovery, development of vestibulo-vegetative sympomocomplex during early adaptation to zero g, signs of decline in vestibulo-vegetative tolerance postflight, and changes in reciprocal relations between the otolith organ and semicircular canals. M.G.

N81-21738# Joint Publications Research Service, Arlington, Va.

RESULTS OF VECTORCARDIOGRAPHIC EXAMINATIONS DURING AND AFTER LONG TERM SPACE FLIGHTS ABOARD THE SALYUT-6-SOYUZ ORBITAL COMPLEX c52

Z. A. Golubchikova, A. D. Yegorov, and V. V. Kalinichenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 31-25 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 23-26 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Bioelectrical activity of the myocardium was examined during and after 96 and 140 day flights, both to assess the ongoing health status of the cosmonauts and to demonstrate the general patterns and mechanisms of changes in bioelectrical activity of the myocardium in the course of prolonged weightlessness. For this purpose, the electrocardiograms were recorded with subsequent analysis of the dynamics of magnitude and direction of electromotive forces of the heart during and after flights. Most marked changes in the form of a decrease in the integral spatial repolarization vector were seen postflight. This parameter did not return to normal during one month postflight. Depolarization vector and vector orientation remained essentially unchanged. M.G.

N81-21739# Joint Publications Research Service, Arlington, Va.

CONFORMITY WITH HUMAN REQUIREMENTS OF PROTEIN CONTAINED IN THE RATIONS FOR CREWS OF THE SALYUT-6 ORBITAL STATION c54

V. P. Bychkov, A. K. Sivuk, and I. I. Borodulina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 36-39 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 26-29 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Nitrogen metabolism in 16 test subjects and 8 cosmonauts kept on a diet containing dehydrated products and foodstuffs preserved by other methods (15 percent and 85 percent, respectively) was studied. The health state and excretion of end products of nitrogen metabolism in those people gave evidence that the dietary protein met well bodily requirements under normal conditions, in simulated flight, and in real flight aboard Salyut-6. M.G.

N81-21740# Joint Publications Research Service, Arlington, Va.

STATE OF COSMONAUTS' ADRENOHYPOPHYSEAL SYSTEM FOLLOWING ORBITAL FLIGHTS OF DIFFERENT DURATION c52

V. B. Noskov, I. S. Balakhovskiy, A. I. Grigoryev, I. G. Dlusskaya, and R. K. Kiselev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 40-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 29-32 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

In order to assess the hypophyseal adrenal system and glucocorticoid activity, excretion of total 17 hydroxycorticosteroids (17-HOCS) was measured before and at R+1 day after a standard water load (20 ml/kg). Twenty-six cosmonauts were examined after flights of 2 to 140 days. Although the cosmonauts spent different times in weightlessness, the content and rate of glucocorticoid excretion in the urine during postflight water loads was 1.5 to 2 times higher than during preflight loads. This increased excretion of 17-HOCS was associated with their decreased reabsorption and/or increased glomerular secretion. The latter may be a manifestation of extrarenal action of adrenocorticotropin due to its hyperproduction immediately postflight. M.G.

N81-21741# Joint Publications Research Service, Arlington, Va.

EFFECTS OF SPACE FLIGHTS ON LYMPHOCYTE BLAST TRANSFORMATION IN COSMONAUTS' PERIPHERAL BLOOD c52

A. T. Lesnyak and R. Yu. Tashpulatov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 46-48 refs Transl. into ENGLISH

from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 32-34 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

The postflight investigation of cell mediated immunity of seven cosmonauts showed a significant increase in spontaneous activity of lymphocytes of peripheral blood and a decrease in stimulation of lymphocytes cultured with phytohemagglutinin at R+O. Variations in these parameters were transient, remaining within physiological limits. Two cosmonauts displayed a stable increase in lymphocyte activity during a blast transformation test with Staphylococcus aureus culture filtrate. M.G.

N81-21742# Joint Publications Research Service, Arlington, Va.

CHANGES IN BODY MASS OF COSMONAUTS IN THE COURSE OF A 140-DAY SPACE FLIGHT c52

A. D. Yegorov, I. I. Kasyan, A. A. Zlatorunskiya, S. F. Khlopina, V. A. Talavrinov, I. A. Yevdokimova, Ye. M. Romanov, and V. I. Somov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 49-51 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 34-36 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

During a 140 day space flight, body mass changes of two crew members were measured. No correlation between body mass losses and flight duration was found. Greatest body mass losses occurred on day 44 to 59 in one subject (2.3 to 2.4 kg) and on day 86 in the other. Mass measurement techniques are described. Later the losses decreased. The results suggest that body mass changes varied on an individual basis and depended on many spaceflight factors. M.G.

N81-21743# Joint Publications Research Service, Arlington, Va.

STUDY OF MASS-INERTIA CHARACTERISTICS OF HUMAN BODY SEGMENTS DURING 6-MONTH HYPOKINESIA BY THE GAMMA SCANNING METHOD c52

V. A. Tishler, V. M. Zatsiorskiy, and V. N. Seluyanov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 52-59 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 36-42 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

A radioisotope method of determining mass-inertia characteristics of human body segments is described and the utilization in measuring body masses of 18 test subjects exposed to 6 month hypokinesia is discussed. It was found that there was a distinct redistribution of body masses in the test subjects. Six of them (who did not exercise) showed losses of muscle mass (primarily antigravity muscles) and gain of adipose mass, and 12 test subjects (who exercised as a countermeasure against hypokinetic effects) displayed insignificant losses of muscle mass and significant gain of adipose mass. M.G.

N81-21744# Joint Publications Research Service, Arlington, Va.

CHEMICAL COMPOSITION OF MINERAL COMPONENT OF HUMAN VERTEBRAE AND CALCANEUS AFTER HYPOKINESIA c52

A. I. Volozhin, I. Ye. Didenko, and G. P. Stupakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 60-63 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan.-Feb. 1981 p 43-44 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

The chemical composition of human bone tissue during long-term hypokinesia was investigated. Hypokinesia of 20 to 42 days led to a decrease of Ca content and increase of K and Na content in the mineral component of human vertebrae; the Mg and P content remaining unchanged. It is suggested that these changes resulted from shifts in ion metabolism on the surface of hydroxyl-appatite crystals as well as from an increase in the content of calcium phosphate amorphous component. The hypokinesia did not cause chemical changes in the inorganic component of os calcis, probably due to the low metabolic activity of its microstructures. After hypokinetic exposure the mineral density of vertebrae and os calcis did not differ from the control value, i.e., no osteoporosis was seen. M.G.

N81-21745# Joint Publications Research Service, Arlington, Va.

EFFECT OF REMAINING BRIEFLY IN ORTHOSTATIC AND ANTIORTHOSTATIC POSITIONS ON MAN'S TRACKING PERFORMANCE c52

Yu. N. Taranenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 64-68 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 45-48 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

Tracking performance under the influence of being in orthostatic and antiorthostatic positions was investigated. A special trainer was used made of a table allowing tilts in the frontal plane equipped with a potentiometric control stick and electron-ray indicator. The results demonstrated that a 30 min exposure to orthostasis or antiorthostasis deteriorated significantly the tracking capacity. It is assumed that the changes were induced by hemodynamic effects due to body position changes. M.G.

N81-21746# Joint Publications Research Service, Arlington, Va.

STATE OF PERIPHERAL BLOOD AS RELATED TO ALTERED DIET AND STRESS c54

M. V. Markaryan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 69-72 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 48-51 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

The effect of diets prepared for prolonged space flights and stress exposures on peripheral blood of 42 healthy male test subjects was studied. The morphology of peripheral blood remained essentially unaltered when test subjects were given dehydrated diets (freshly prepared, stored for 2 years and exposed to proton irradiation at a dose of 24,000 rad) or Salyut-6 space diet. Stress Effects brought about neutrophil leukocytosis and lymphopenia which could be prevented with dietary supplements. Author

N81-21747# Joint Publications Research Service, Arlington, Va.

EFFICACY OF ALIMENTARY FACTORS IN THE RECOVERY PERIOD FOLLOWING LONG-TERM ANTIORTHOSTATIC HYPOKINESIA c52

V. P. Bychkov, K. V. Smirnov, and A. S. Ushakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 73-76 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 51-53 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

The effects of antiorthostatic hypokinesia on the alimentary status of 8 men ranging in age from 36 to 40 years was investigated. Specific emphasis was placed on the parameters of body weight, metabolism (protein, lipid, carbohydrate, vitamin, mineral), and digestive function. The study consisted of three periods: the background period; the hypokinesia period; and the recovery period. The diet of the subjects was strickly regulated and differentiated in accordance with these three periods. Results indicate that diet is a significant factor with respect to the recovery of health status after prolonged head tilt. R.C.T.

N81-21748# Joint Publications Research Service, Arlington, Va.

EFFECT OF LEVEL OF MOTOR ACTIVITY ON AEROBIC EFFICIENCY IN HEALTHY MAN c52

G. V. Machinskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 77-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 54-56 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

The efficacy of physical exercise for endurance in the preservation of the functional capabilities of the cardiorespiratory system was examined in age from 20 to 40 years were investigated. Results indicate that aerobic performance of and individual depends on the degree of his normal motor activity. In subjects leading an active mode of life, the maximum oxygen uptake and general work capacity are significantly higher than those leading a sedantary mode of life. The results further indicate that people with diminished muscle activity should be encouraged to do regular exercises in order to maintain aerobic performance. R.C.T.

N81-21749# Joint Publications Research Service, Arlington, Va.

REGIONAL ANALGESIA BY CONDUCTION ANESTHESIA AND REFLEX THERAPY IN THE ACUTE RECOVERY PERIOD FOLLOWING ANTIORTHOSTATIC HYPOKINESIA **c52**

L. L. Stazhadze, A. V. Vabishchevich, V. N. Tsibulyak, G. V. Chubarov, A. A. Titov, M. N. Avakyan, Zh. M. Kudryashova, V. V. Lenskiy, and V. V. Bogomolov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 57-60 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

The constant tendancy towards increased volume and complexity of special work done in orbit increases the risk of trauma to different parts of the body (dislocations, fractures, burns, etc.). An attempt was made to choose and use methods of controlling pain that would not themselves cause any additional and appreciable destabilization of systems that regulate homeostasis. Two methods of regional anesthesia were studied with respect to alleviating pain and preventing shock reactions in such cases. A total of six healthy male subjects were exposed to peridural anesthesia (3 subjects) and electroauricular anesthesia (3 subjects). Results indicate that the anesthetic effect is not accompanied by significant changes in hemodynamics or homeostasis. R.C.T.

N81-21750# Joint Publications Research Service, Arlington, Va.

ACCELERATIONS AFFECTING MAN IN STORMY WEATHER **c52**

V. N. Barnatskiy, A. T. Poleshchuk, A. A. Shipov, and V. A. Babushkin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 87-88 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 61-62 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

The characteristics of accelerations that occur during violent and harsh storms, to which man is exposed aboard ship were studied. It is shown that as a storm develops, even when the ship is held strickly head into the wave, the incidence of seasickness increases. R.C.T.

N81-21751# Joint Publications Research Service, Arlington, Va.

STUDY OF HUMAN VESTIBULAR REACTIONS TO SIMULATED PERIODIC SHIP ROLLING **c52**

V. M. Gusev, T. A. Nalimova, and V. A. Kislyakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 89-95 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 63-66 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Hydromechanical reactions of the semicircular canal were investigated in the presence of periodic exogenous influences of the ship rolling type. Results indicate that these reactions can serve as rather accurate approximations of the vector of absolute angular velocity of the human body. With the head in normal position in relation to the body, the influence of crus commune is manifested by improved approximation of components of absolute angular velocity that are represented by the vertical canals. R.C.T.

N81-21752# Joint Publications Research Service, Arlington, Va.

HUMAN COLOR DISCRIMINATION DURING VESTIBULAR STIMULATION AFTER EXPOSURE TO BRIGHT LIGHT **c53**

Zh. M. Kudryashova and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 96-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1 Jan. - Feb. 1981 p 66-70 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Color discriminating functions were tested in subjects of both sexes in a situation often encountered when driving different vehicles, namely, during vestibular stimulation after exposure to very bright light. Results indicate that drastic changes in illumination, created by creating light of 2.5 times 10 to the third power to 50 times 10 to the third power nit, lead to temporary color blindness, diminish central color and brightness contrast sensitivity, as well as lower the level of functional stability of color discrimination. R.C.T.

N81-21753# Joint Publications Research Service, Arlington, Va.

EFFECT OF SPECIFIC VOLUME ON FORMATION OF ATMOSPHERE IN SEALED COMPARTMENTS **c54**

V. P. Savina, Yu. G. Nefedov, T. I. Kuznetsova, V. Ye. Ryzhkova, K. N. Mikos, and K. V. Grishina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 102-105 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1 Jan. - Feb. 1981 p 70-72 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Atmosphere pollution with noxious gaseous trace contaminants exhaled by man in an enclosure was investigated as a function of free volume per man. The parameter is shown to depend on the environmental conditions: with increase in free volume the total level of atmosphere pollution decreased, being proportional to the concentration of gaseous trace contaminants in the exhaled air. Experimental curves of accumulation of gaseous chemicals exhaled by man were constructed. R.C.T.

N81-21754# Joint Publications Research Service, Arlington, Va.

EFFECT OF SPACE FLIGHT FACTORS ON ULTRASTRUCTURE OF SKELETAL MUSCLES **c52**

K. D. Rokholenko and Z. F. Savik *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 106-111 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 72-77 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Ultrastructures of myofibers of the soleus and gastrocnemius muscles of rats flown in zero-g and 1 g were examined. It was found that 4.5 to 9 hours postflight the soleus of weightless rats showed focal destruction of the contractile and mitochondrial systems accompanied by metabolic changes in muscle fibers. Exposure to artifical gravity partially prevented changes in muscle fibers. Examinations of muscle fibers 25 days postflight demonstrated that the changes were reversible. No changes were observed in the mixed (gastrocnemius) muscle of both animal groups. R.C.T.

N81-21755# Joint Publications Research Service, Arlington, Va.

ULTRASTRUCTURE OF THE MYOCARDIUM OF RATS FLOWN ABOARD THE COSMOS-936 BIOSATELLITE

K. D. Rokhlenko and P. Ya. Muldiyarov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 112-118 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1 Jan. - Feb. 1981 p 77-82 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Hearts of rats flown for 19.5 days aboard the biosatellite Cosmos-936 and decapitated 4.5 to 9 hours or 25 days postflight

were examined electron microscopically. Hearts of weightless rats sacrificed at R + O showed marked and consistent changes in capillaries and venules; myeline transformation of membranes of mitochondria and sarcoplasmatic reticulum was observed in cardiomyocytes which did not show lysis. It is assumed that development of myelin bodies and increase in the number of auto phagosomes in weightless rats were caused by disintegration of mitochrondrial and sarcoplasmatic reticulum structures. Rats exposed inflight to artificial gravity displayed less pronounced submicroscopic changes. R.C.T.

N81-21756# Joint Publications Research Service, Arlington, Va.

PHOSPHATASE ACTIVITY OF RAT ANTEBRACHIAL BONES AFTER FLIGHT ABOARD THE COSMOS-936 BIOSATELLITE

I. A. Popova and R. A. Tigranyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 119-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 82-84 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

Activities of alkaline and acid phosphatases in ulnar and radial bones of rats flown for 18.5 days aboard Cosmos-936 and kept in a ground based mockup were investigated. In both bones activity of acid phosphatase increased significantly and that of alkaline phosphatase decreased 6 to 10 hours postflight; in the synchronous experiment the only change was a decrease in the activity of alkaline phosphatase in the radius. An exposure of rats to artificial gravity did not normalize changes in phosphatase activities observed postflight. At R + 25 phosphatase activity in bones of flight rats returned to normal and even tended to exceed the control level in synchronous animals. R.C.T.

N81-21757# Joint Publications Research Service, Arlington, Va.

CHEMICAL COMPOSITION OF MINERAL COMPONENT OF RABBIT BONES AS RELATED TO 30-DAY HYPOKINESIA

I. Ye. Didenko and A. I. Volozhin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 123-1127 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 84-87 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

The mineral component of the bones of rabbits were exposed to hypokinesia for 30 days. There were no changes observed in the Ca and P content or in the Ca/P ratio but a decrease in the Mg, Na and K content was detected. Possible involvement of bone tissue in the maintenance of electrolyte composition during prolonged hypokinesia is discussed. R.C.T.

N81-21758# Joint Publications Research Service, Arlington, Va.

EFFECT OF HYPERBARIC NITROGEN AND OXYGEN ATMOSPHERE ON ACTIVITY OF RESPIRATORY CENTER

c52

I. S. Breslav, N. Z. Klyuyeva, and G. V. Troshikhin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 128-131 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 88-89 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

In anesthesized cats inspiratory activity of the respiratory center at first increased and then decreased with increases in total pressure of the nitrogen-oxygen atmosphere to 7, 11 and 21 atm (at normal PO2). The effort made by respiratory muscles increased gradually. These changes were augmented by hypercapnia. Possible role of nitrogen anesthesia and compensatory reactions to the increased breathing resistance in the development of the above changes is discussed. R.C.T.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-21759* National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO THE 1980 ISSUES

Jan. 1981 343 p

(NASA-SP-7011(215)) Avail: NTIS HC $11.00 CSCL 06E

A cumulative index to the abstracts contained in the Supplements 203 through 214 of Aerospace Medicine and Biology: A Continuing Bibliography is presented. It includes three indexes--subject, personal author, and corporate source. M.G.

N81-21760*# National Aeronautics and Space Administration, Washington, D. C.

GROUND EXPERIMENTS FOR FINDING PRINCIPLES AND WORKING OUT METHODS FOR PREVENTING ADVERSE EFFECTS OF WEIGHTLESSNESS ON THE HUMAN ORGANISM

L. I. Kakurin, A. I. Gregoryev, V. M. Mikhailov, and V. A. Tishler Dec. 1980 43 p refs Transl. into ENGLISH of "Nazemnyye Eksperimenty s Tselyu Obosnovaniya i Razrabotki Metodov Profilaktiki Neblagopriyatnogo Deystviya Nevesomosti na Organizm Cheloveka" Moscow, Oct. 1980 57 p Presented to the IX Joint Soviet-Am. Working Group on Space Biol. and Med., Moscow, Oct. 1980 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Medical and Biological Problems, Soviet Ministry of Health, Moscow

(Contract NASw-3199)

(NASA-TM-76465) Avail: NTIS HC A03/MF A01 CSCL 06P

A comparative assessment of the effectiveness of different prophylactic procedures to prevent the adverse effects of weightlessness is presented. It is concluded that: physical training is most effective but no single method by itself produces the full effect, and an adjustment of regimes to one another enhances the effect. The approved complex of prophylactic procedures affected basic changes occurring in hypokinesia: deficit of muscular activity, no or reduced BP hydrostatic component, reduced volume of blood circulation, reduced hydration level, and the application of various prophylactic complexes during 49 day antiorthostatic hypodynamia eliminated or reduced the adverse effects of weightlessness in simulation. M.G.

N81-21761*# National Aeronautics and Space Administration, Washington, D. C.

THE PHYSIOLOGICAL EFFECTS OF DEHYDRATION CAUSED BY SWEAT LOSS

S. Israel Mar. 1981 24 p refs Transl. into ENGLISH from Med. u. Sport 20 (Leipzig), no. 10, 1980 p 300-306 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. for Leisure and Recreational Sport, Leipzig

(Contract NASw-3199)

(NASA-TM-75893) Avail: NTIS HC A02/MF A01 CSCL 06P

The mechanisms of fluid loss in the human body while sweating due to physical exercise are discussed. Trained and untrained persons were examined and compared. Since sweat is hypotonous, a disruption in the hydrosalinic balance occurs; the consequences of this finding, also pertaining to the fluid and electrolytic substitution, are presented. Further explanations on the problem of dehydration refer to reactions of individual organ systems, to alterations in bodily capabilities as well as to questions relating to sex and age. Author

N81-21762# Oak Ridge National Lab., Tenn. Information Div.

SCIENTIFIC RATIONALE FOR THE SELECTION OF TOXICITY TESTING METHODS: HUMAN HEALTH ASSESSMENT

R. H. Ross, Michael G. Ryon, Mary W. Daugherty, John S. Drury, John T. Ensminger, and M. Virginia Cone Dec. 1980 423 p refs

(Contract W-7405-eng-26)

(ORNL/EIS-151; EPA-560/1-80-001) Avail: NTIS HC A18/MF A01

The first of a two part literature analysis of parameters associated with the various toxicity testing methods (test animal selection, pathology requirements, etc.) is reviewed. Acute, subchronic, chronic, and carcinogenic testing methods are covered: a discussion of some basic experimental considerations is included. DOE

N81-21763# Environmental Protection Agency, Washington, D.C. Office of Pesticides and Toxic Substances.

PROCEEDINGS OF THE WORKSHOP ON SUBCHRONIC TOXICITY TESTING

N. Page, Daljit Sawhney, and Michael G. Ryon Nov. 1980 70 p refs Workshop held at Denver, Colorado, 20-24 May 1979

(Contract W-7405-eng-26)

(ORNL/EIS-189; EPA-560/11-80-028) Avail: NTIS HC A04/MF A01

Subchronic toxicity procedures are designed to determine the adverse effects that may occur with repeated exposure over a part of the average life span of an experiment animal. The workshop objectives included critically examining the subchronic study as it might be applied to general chemical testing programs and evaluating the effect of variations in study parameters on assessment potential; identifying the deficiencies in the existing scientific knowledge and recommending research to strengthen the testing program; and identifying the related scientific issues to be resolved in future workshops or experimental programs. DOE

N81-21764# European Space Agency, Paris (France).

ANALYSIS OF HEART RATE VARIABILITY AS AN ESTIMATE OF PILOT WORKLOAD IN HUMAN ENGINEERING RESEARCH

Fred Volker Schick and Hans Radke Oct. 1980 32 p refs Transl. into ENGLISH of "Untersuchung der Pulsfrequenzvariabilitaet als Schaetzgroesse der Pilotenbeanspruchung bei Anthropotech. Experimenten", DFVLR, Brunswick Report DFVLR-FB-79-33, Jul. 1979 Original report in GERMAN previously announced as N80-27086

(ESA-TT-653; DFVLR-FB-79-33) Avail: NTIS HC A03/MF A01

The usefulness of measurements of heart rate variability (HRV) for the assessment of pilot stress was studied in a laboratory experiment. A number of HRV parameters were recorded with respect to various experimentally controlled levels of mental workload. A tracking task with three levels of difficulty was presented to 12 test subjects. The heart rate variability was determined in the form of standard deviations, sums of absolute differences and the frequency of instantaneous heart rate reversals. The data were analyzed by statistical methods. The HRV parameters showed such a wide dispersion that it is not possible to detect differences in stress as a result of changes in task difficulty. Author (ESA)

N81-21736# Joint Publications Research Service, Arlington, Va.

PHARMACOLOGICAL AGENTS FOR THE PREVENTION AND TREATMENT OF MOTION SICKNESS

V. S. Shashkov and V. V. Sabayev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 10-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 9-18 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21738# Joint Publications Research Service, Arlington, Va.

RESULTS OF VECTORCARDIOGRAPHIC EXAMINATIONS DURING AND AFTER LONG TERM SPACE FLIGHTS ABOARD THE SALYUT-6-SOYUZ ORBITAL COMPLEX

Z. A. Golubchikova, A. D. Yegorov, and V. V. Kalinichenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 31-25 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 23-26 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21740# Joint Publications Research Service, Arlington, Va.

STATE OF COSMONAUTS' ADRENOHYPOPHYSEAL SYSTEM FOLLOWING ORBITAL FLIGHTS OF DIFFERENT DURATION

V. B. Noskov, I. S. Balakhovskiy, A. I. Grigoryev, I. G. Diusskaya, and R. K. Kiselev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 40-45 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 29-32 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21741# Joint Publications Research Service, Arlington, Va.

EFFECTS OF SPACE FLIGHTS ON LYMPHOCYTE BLAST TRANSFORMATION IN COSMONAUTS' PERIPHERAL BLOOD

A. T. Lesnyak and R. Yu. Tashpulatov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 46-48 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 32-34 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21742# Joint Publications Research Service, Arlington, Va.

CHANGES IN BODY MASS OF COSMONAUTS IN THE COURSE OF A 140-DAY SPACE FLIGHT

A. D. Yegorov, I. I. Kasyan, A. A. Zlatorunskiya, S. F. Khlopina, V. A. Talavrinov, I. A. Yevdokimova, Ye. M. Romanov, and V. I. Somov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 49-51 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 34-36 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21743# Joint Publications Research Service, Arlington, Va.

STUDY OF MASS-INERTIA CHARACTERISTICS OF HUMAN BODY SEGMENTS DURING 6-MONTH HYPOKINESIA BY THE GAMMA SCANNING METHOD

V. A. Tishler, V. M. Zatsiorskiy, and V. N. Seluyanov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 52-59 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 36-42 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21744# Joint Publications Research Service, Arlington, Va.

CHEMICAL COMPOSITION OF MINERAL COMPONENT OF HUMAN VERTEBRAE AND CALCANEUS AFTER HYPOKINESIA

A. I. Volozhin, I. Ye. Didenko, and G. P. Stupakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 60-63 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan.-Feb. 1981 p 43-44 (For primary document see N81-21735 12-51)

Avail: NTIS HC A07/MF A01

N81-21745# Joint Publications Research Service, Arlington, Va.

EFFECT OF REMAINING BRIEFLY IN ORTHOSTATIC AND ANTIORTHOSTATIC POSITIONS ON MAN'S TRACKING PERFORMANCE

Yu. N. Taranenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 64-68 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 45-48

(For primary document see N81-21735 12-51)
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N81-21747# Joint Publications Research Service, Arlington, Va.
EFFICACY OF ALIMENTARY FACTORS IN THE RECOVERY PERIOD FOLLOWING LONG-TERM ANTIORTHOSTATIC HYPOKINESIA
V. P. Bychkov, K. V. Smirnov, and A. S. Ushakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 73-76 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 51-53 (For primary document see N81-21735 12-51)
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EFFECT OF LEVEL OF MOTOR ACTIVITY ON AEROBIC EFFICIENCY IN HEALTHY MAN
G. V. Machinskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 77-80 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 54-56 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21749# Joint Publications Research Service, Arlington, Va.
REGIONAL ANALGESIA BY CONDUCTION ANESTHESIA AND REFLEX THERAPY IN THE ACUTE RECOVERY PERIOD FOLLOWING ANTIORTHOSTATIC HYPOKINESIA
L. L. Stazhadze, A. V. Vabishchevich, V. N. Tsibulyak, G. V. Chubarov, A. A. Titov, M. N. Avakyan, Zh. M. Kudryashova, V. V. Lenskiy, and V. V. Bogomolov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 81-85 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 57-60 (For primary document see N81-21735 12-51)
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N81-21750# Joint Publications Research Service, Arlington, Va.
ACCELERATIONS AFFECTING MAN IN STORMY WEATHER
V. N. Barnatskiy, A. T. Poleshchuk, A. A. Shipov, and V. A. Babushkin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 87-88 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 61-62 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21751# Joint Publications Research Service, Arlington, Va.
STUDY OF HUMAN VESTIBULAR REACTIONS TO SIMULATED PERIODIC SHIP ROLLING
V. M. Gusev, T. A. Nalimova, and V. A. Kislyakov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 89-95 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 63-66 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21754# Joint Publications Research Service, Arlington, Va.
EFFECT OF SPACE FLIGHT FACTORS ON ULTRASTRUCTURE OF SKELETAL MUSCLES
K. D. Rokholenko and Z. F. Savik *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 106-111 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 72-77 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21758# Joint Publications Research Service, Arlington, Va.
EFFECT OF HYPERBARIC NITROGEN AND OXYGEN ATMOSPHERE ON ACTIVITY OF RESPIRATORY CENTER
I. S. Breslav, N. Z. Klyuyeva, and G. V. Troshikhin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 128-131 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 88-89 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-21765# California Univ., San Diego, La Jolla. Center for Human Information Processing.
UNDERSTANDING UNDERSTANDING Progress Report, Dec. 1978 - Dec. 1980
David E. Rumelhart Jan. 1981 40 p refs
(Contract N00014-79-C-0323; Grant NSF BNS-76-15024; NR Proj. 157-437)
(AD-A096290; CHIP-100; CHIP-8101) Avail: NTIS HC A03/MF A01 CSCL 05/10

The schema theoretic view of comprehension is reviewed. Several techniques for the study of on-line measures of comprehension are developed. The techniques include a question probe technique and a reading time technique. Data were collected using each of these techniques and the results are compared with each other. The results are then interpreted in terms of a schema theoretical view of comprehension. GRA

N81-21766# Calspan Advanced Technology Center, Buffalo, N.Y.
VISUAL DETECTION MODEL FOR STRUCTURED TARGETS (PENVAL PROGRAM) Interim Report, 31 May - 30 Sep. 1979
Harry B. Hammill and William D. Fryer Nov. 1980 98 p refs
(Contract F33615-78-C-1550)
(AD-A096084; CALSPAN-6364-X-13) Avail: NTIS HC A05/MF A01 CSCL 06/16

A mathematical/software model was generated for the purpose of predicting the visual detectability of aircraft (under conditions of search) based on target contrast structure when average contrast is otherwise arbitrarily low. The model was partially validated and subsequently employed to investigate a series of target contrast structure functions. The report includes a complete mathematical development of the model and a fully documented software User's Guide. GRA

N81-21767# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Psychology.
KNOWLEDGE COMPILATION: MECHANISMS FOR THE AUTOMATIZATION OF COGNITIVE SKILLS
David M. Neves and John R. Anderson 25 Jul. 1980 55 p refs
(Contract N00014-78-C-0725; RR0420401)
(AD-A096117; TR-80-4) Avail: NTIS HC A04/MF A01 CSCL 05/9

People get better on a task with practice. In this paper we take this non-controversial statement, elaborate what it means to 'get better', and propose a mechanism that accounts for some of the ways people get better. We trace the development of a skill from the point when it is initially being memorized and applied in a slow and halting fashion to the point where it has become fast and automatic through practice. We are interested in how students learn to use postulates and theorems in geometry tasks. A scenario of how a student (based on two students we have looked at in detail in geometry and three subjects working on an artificial proof system) learns postulates is as follows. The student reads each of several postulates in a section of a textbook. After a brief inspection of the postulates the student goes on to the problems at the end of the section that require

the student to use the postulates. In the student's initial attempts with the postulates there is much looking back to them in the textbook because they have not yet been committed to memory. These applications are slow and there is muttering that shows low level matching of the postulates like 'If A is RO and B is NY then I can assert that'. After some practice the student has committed the postulates to memory. After much practice their selection and application is very fast. GRA

N81-21768# European Space Agency, Paris (France).
INFLUENCE OF THE FLIGHT ALTITUDE AND LIMITATION OF THE FIELD OF VIEW ON THE VISIBILITY OF TARGETS ON THE GROUND AND THE MAXIMUM VISIBILITY FLIGHT ALTITUDE
Hans-Eberhard Hoffmann Jun. 1980 43 p refs Transl. into ENGLISH of 'Der Einfluss der Flughoehe u. Gesichtsfeldbegrenzung auf die Sichtbarkeit von Objekten am Boden u. die maximale Sichtbarkeitsflughoehe', DFVLR, Oberpfaffenhofen, West Germany Report DFVLR-FB-79-35 Original report in GERMAN previously announced as N80-27095
(ESA-TT-654; DFVLR-FB-79-35) Avail: NTIS HC A03/MF A01

The visiblity of targets on the ground for observers in an aircraft was studied by means of naked eye observations from a helicopter. The maximum flight altitudes at which detection, recognition, or identification of ground targets is still possible were calculated under the assumption that the visibility distance is a lagarithmic function of the altitude. The constants of this function were determined experimentally, and are given.
Author (ESA)

N81-21737# Joint Publications Research Service, Arlington, Va.
RESULTS OF STUDIES OF VESTIBULAR FUNCTION AND SPATIAL PERCEPTION IN THE CREWS OF THE FIRST AND SECOND EXPEDITIONS ABOARD SALYUT-6 STATION
I. Ya. Yakovleva, L. N. Kornilova, G. D. Syrykh, I. K. Tarasov, and V. N. Alekseyev *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 25-30 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 19-23 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21752# Joint Publications Research Service, Arlington, Va.
HUMAN COLOR DISCRIMINATION DURING VESTIBULAR STIMULATION AFTER EXPOSURE TO BRIGHT LIGHT
Zh. M. Kudryashova and A. A. Shipov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 96-101 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1 Jan. - Feb. 1981 p 66-70 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-21769*# National Aeronautics and Space Administration, Washington, D. C.
MACHINE INTELLIGENCE AND ROBOTICS: REPORT OF THE NASA STUDY GROUP Final Report
Mar. 1980 259 p refs
(NASA-TM-82329) Avail: NTIS HC A12/MF A01 CSCL 05H

Opportunities for the application of machine intelligence and robotics in NASA missions and systems were identified. The benefits of successful adoption of machine intelligence and robotics techniques were estimated and forecasts were prepared to show their growth potential. Program options for research, advanced development, and implementation of machine intelligence and robot technology for use in program planning are presented.
T.M.

N81-21770*# Life Systems, Inc., Cleveland, Ohio.
FRACTIONAL CAPACITY ELECTROLYZER DEVELOPMENT FOR CO2 AND H2O ELECTROLYSIS
R. A. Wynveen Jun. 1980 49 p refs
(Contract NAS2-9862)
(NASA-CR-166149; LSI-TR-341-4) Avail: NTIS HC A03/MF A01 CSCL 06K

The electrolyzer module was designed to produce 0.24 kg/d (0.53 lb/d) of breathable oxygen from the electrolysis of metabolic carbon dioxide and water vapor. The fractional capacity electrolyzer module is constructed from three electrochemical tube cells and contains only three critical seals. The module design illustrated an 84 percent reduction in the total number of seals for a one person capacity oxygen generating system based on the solid electrolyte carbon dioxide and water vapor electrolysis concept. The electrolyzer module was successfully endurance tested for 71 days.
T.M.

N81-21771*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEVELOPMENT OF A PREPROTOTYPE HYPERFILTRATION WASH WATER RECOVERY SUBSYSTEM Final Report
Jan. 1981 135 p refs
(Contract NAS9-15183)
(NASA-CR-160926; LMSC-D772059) Avail: NTIS HC A07/MF A01 CSCL 06K

The use of hyperfiltration as a mode of reclamation of waste water on board an extended mission spacecraft was investigated. Two basic approaches are considered with respect to hyperfiltration of wash water recovery. The initial approach involves the use of a hollow fiber permeator and a tubular module, operating at ambient temperature. In this system, relatively large doses of biocides are used to control microbial activity. Since biocides require a long contact time, and many have adverse dematological effects as well as many interact with membrane material, a second approach is considered which involves operating at pasturization temperature.
R.C.T.

N81-21772*# Stanford Univ., Calif.
CONTROL OF A FLEXIBLE ROBOT ARM Final Report
Eric Schmitz and Robert Cannon Jan. 1980 28 p refs Prepared for JPL
(JPL-955636)
(NASA-CR-16416; JPL-9950-517) Avail: NTIS HC A03/MF A01 CSCL 05H

Exact equations of motion of an arm with known parameters were developed and analyzed preparatory to designing control systems for robotic manipulators. The design of an experimental one-link arm for testing control designs is presented.
T.M.

N81-21773# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
AUTOMATIC PLANNING OF MANIPULATOR TRANSFER MOVEMENTS
Thomas Lozano-Perez Dec. 1980 56 p refs
(Contract N00014-77-C-0389)
(AD-A096118; AI-M-602) Avail: NTIS HC A04/MF A01 CSCL 13/9

This paper deals with the class of problems that involve finding where to place or how to move a solid object in the presence of obstacles. The solution to this class of problems is essential to the automatic planning of manipulator transfer movements, i.e., the motions to grasp a part and place it at some destination. This paper presents algorithms for planning manipulator paths that avoid collisions with objects in the workspace and for choosing safe grasp points on objects. These algorithms allow planning transfer movements for cartesian manipulators. The approach is based on a method of computing an explicit representation of the manipulator configurations that would bring about a collision.
GRA

N81-21774# Rochester Univ., N. Y. School of Medicine and Dentistry.
BEHAVIOR AS A COMMON FOCUS OF TOXICOLOGY AND NUTRITION

Bernard Weiss 1980 28 p refs Presented at the Nutr. and Behavior Conf., Williamsburg, Va., 7 Mar. 1980
(Contract DE-AC02-76EV-03490; Grant NIMH-MH-11752)
(UR-3490-1826; CONF-8003119-1) Avail: NTIS HC A03/MF A01

Behavior as an index of toxicity parallels its role as an index of nutritional impairment, just as toxicology and nutrition share other common themes. Intersections among the three disciplines arise because foodstuffs serve as one of the major routes of toxic exposure and also because food elements modify toxicity. With this perspective, the safety of our food supply is examined in the contexts of essential nutrients, toxins, toxic metals, manufactured contaminants, self-administered toxicants, and food additives. DOE

N81-21739# Joint Publications Research Service, Arlington, Va.
CONFORMITY WITH HUMAN REQUIREMENTS OF PROTEIN CONTAINED IN THE RATIONS FOR CREWS OF THE SALYUT-6 ORBITAL STATION
V. P. Bychkov, A. K. Sivuk, and I. I. Borodulina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 36-39 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 26-29 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21746# Joint Publications Research Service, Arlington, Va.
STATE OF PERIPHERAL BLOOD AS RELATED TO ALTERED DIET AND STRESS
M. V. Markaryan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 69-72 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1, Jan. - Feb. 1981 p 48-51 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

N81-21753# Joint Publications Research Service, Arlington, Va.
EFFECT OF SPECIFIC VOLUME ON FORMATION OF ATMOSPHERE IN SEALED COMPARTMENTS
V. P. Savina, Yu. G. Nefedov, T. I. Kuznetsova, V. Ye. Ryzhkova, K. N. Mikos, and K. V. Grishina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 15, No. 1, Jan. - Feb. 1981 (JPRS-77513) 5 Mar. 1981 p 102-105 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (USSR), v. 15, no. 1 Jan. - Feb. 1981 p 70-72 (For primary document see N81-21735 12-51)
Avail: NTIS HC A07/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N81-21775*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MARKING PARTS TO AID ROBOT VISION
John W. Bales (Tuskegee Inst., Ala.) and L. Keith Barker Apr. 1981 36 p
(NASA-TP-1819; L-14055) Avail: NTIS HC A03/MF A01 CSCL 12A

The premarking of parts for subsequent identification by a robot vision system appears to be beneficial as an aid in the automation of certain tasks such as construction in space. A simple, color coded marking system is presented which allows a computer vision system to locate an object, calculate its orientation, and determine its identity. Such a system has the potential to operate accurately, and because the computer shape analysis problem has been simplified, it has the ability to operate in real time. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N81-21776# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SYSTOLIC (VLSI) ARRAYS FOR RELATIONAL DATABASE OPERATIONS, REVISION Interim Report
H. T. Kung and Philip L. Lehman Mar. 1980 33 p Presented at the 1980 ACM/SIGMOD Intern. Conf. on Management of Data, Los Angeles, 14-16, May 1980
(Contracts N00014-76-C-0370; N00014-80-C-0236; Grant NSF MCS-78-23676; ARPA Order 3597)
(AD-A096378; CMU-CS-80-114-Rev) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper proposes the use of VLSI technology to perform relational database operations directly in hardware. It is shown that relational computations, such as intersection, remove-duplicates, union, join, and division, can all be pipelined elegantly and efficiently on networks of processors having an array structure. These (systolic) processor arrays are readily and cost-effectively implementable with present technology, due to the extreme simplicity of their processors, and the high regularity of their interconnection structures. GRA

N81-21777# Maryland Univ., College Park. Computer Vision Lab.
RECONFIGURABLE CELLULAR COMPUTERS
Azriel Rosenfeld and Angela Y. Wu Oct. 1980 38 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A096005; CSC-TR-963; AFOSR-81-0138TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

When a collection of processors C= (P sub i,..., P sub n) operates in parallel, it is desirable that at any given stage of the computation, each P sub i should have a task of about the same size to perform, and each P sub i should require about the same amount of information from the other P's in order to perform its task. To the extent that these conditions are violated, parallelism is impaired, in the sense that the P's are not all used with equal efficiency. In cellular computers, e.g., as they might be used for parallel image processing, these conditions are maintained by having the P's all perform similar computations on different parts of the input data, and by allowing each P sub i to receive information from a fixed set of the others (its 'neighbors'), where these sets are all of bounded size. This paper discusses, on an abstract level, the concept of a reconfigurable cellular computer, in which each P sub i can receive information from a set of S sub i of the other P's, and the S sub i's are all of bounded size, but they need not remain fixed throughout a computation. Requiring the S sub i's to have bounded size implies that most P's cannot communicate directly; the expected time required for two arbitrary P's to communicate depends on the graph structure defined by the sets S sub i. The question of how to change the S sub i's in parallel during the course of a computation is also discussed. GRA

N81-21778# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESTRUCTURABLE VLSI PROGRAM Semiannual Technical Summary Report, 1 Apr. 1979 - 31 Mar. 1980
Allan H. Anderson 31 Mar. 1980 34 p refs
(Contract F19628-80-C-0002; ARPA Order 3797)

(AD-A096075; ESD-TR-80-192) Avail: NTIS
HC A03/MF A01 CSCL 09/2

The objective of the Restructurable Very Large Scale Integration (RVLSI) Program is to develop and demonstrate techniques which will make possible integration of large systems as single-package modules. We are developing techniques for restructuring large-area IC chips after fabrication in order to provide access for testing, perform defect avoidance and customization, and reconfigure a system while it is being used. The DARPA-sponsored program is focused on development or architectural concepts for data- and signal-processing systems for RVLSI implementation, development of design aids for unique RVLSI design problems, and development of test techniques suitable for RVLSI applications. An overview of the goals and proposed techniques is given in Sec. 2. In Sec. 3 the functional requirements on programmable connections or links are presented and three types of links are described and compared. In the near term the emphasis will be on laser programmed links and links made from standard logic circuitry; a longer-term goal is development of an electrically programmable nonvolatile link. In Sec. 4 we describe a hardware description language designed for efficient description of hierarchical and iterative structures of digital circuits. Since each RVLSI chip may have a different wiring configuration, complete automation of the signal routing process is essential. Solutions for this problem are presented in Sec. 4. Results of an investigation of mapping a regular locally connected array of processing elements onto a physical array with defective elements are presented in Sec. 5. An integrator for a spread-spectrum packet radio receiver has been chosen for a first implementation. GRA

N81-21779# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

PROPERTIES OF THE AUGMENTED DATA MANIPULATOR NETWORK IN AN SIMD ENVIRONMENT Interim Report

George B. Adams, III and Howard Jay Siegel Dec. 1980 108 p refs

(Grant AF-AFOSR-3581-78; AF Proj. 2304)
(AD-A096399; TR-EE80-51; AFOSR-81-0203TR) Avail: NTIS
HC A06/MF A01 CSCL 09/2

The demand for computers with ever greater throughput coupled with the decreased costs accompanying advances in semiconductor technology has created a great deal of interest in parallel processing systems. Single instruction stream - multiple data stream (SIMD) machines and multiple instruction stream - multiple data stream (MIMD) machines are two types of parallel processing system architectures. PASM is a partitionable SIMD/MIMD parallel processor, intended to operate in either mode of parallelism, being developed at Purdue University. The interconnection network chosen for this system will greatly influence its performance. The Generalized Cube and the Augmented Data Manipulator (ADM) are two networks being considered for use in PASM. This work is primarily concerned with the capabilities of the ADM network in SIMD mode. The number of data permutations passable by the ADM network is explored. Routing tag schemes are described for both the Generalized Cube and ADM networks. Algorithms for determining permutation passability in the ADM network using three related types of routing tags for distributed network control are presented. Correctness proofs are given and algorithm complexity determined. To further investigate ADM network capabilities in SIMD mode, group theory is used to derive additional properties. It is shown that the ADM network cannot pass all even permutations when $N < or = 8$. GRA

N81-21780# Naval Ship Research and Development Center, Bethesda, Md. Computer Mathematics/Logistics Dept.

FREQUENCY TRACK STORAGE FOR A SIGNAL ANALYSIS SYSTEM

Christopher J. Slominski Jan. 1981 32 p
(SR0140301)
(AD-A095932; DTNSRDC/CMLD-81/01) Avail: NTIS
HC A03/MF A01 CSCL 09/2

The problem of frequency track storage is one small part of implementing a comprehensive signal analysis system. This paper deals only with their storage and does not discuss the signal analysis problem. The frequency tracks are used in signal classification and an optimal data base allowing graphics and statistical analysis is sought. GRA

N81-21781# Naval Postgraduate School, Monterey, Calif.

A COMPUTER EVALUATION TECHNIQUE FOR EARLY SELECTION OF HARDWARE M.S. Thesis

Bart Dallas Hodgins Dec. 1980 125 p refs
(AD-A096302) Avail: NTIS HC A06/MF A01 CSCL 09/2

There is a need for a decision making/early selection tool for use in the government computer selection process. Such early selection tools are critical to the decision maker due to the environment in which the government procurer is forced to operate. The instruction mix sensitivity technique as demonstrated here has the potential to aid the government decision maker in evaluating the performance of a computer prior to the actual existence or availability of that hardware without resorting to costly and time consuming techniques such as simulation or modeling. GRA

N81-21782# IBM Federal Systems Div., Manassas, Va.

ELECTRICAL CHARACTERIZATION OF COMPLEX MEMORIES. PART 2: ASSESSMENT OF A CIRCUIT IMPLEMENTATION TO MEASURE EPROM DATA STORAGE MARGINS Final Technical Report, Jun. 1979 - Sep. 1980

R. A. Moyers, P. Pfeiffer, and F. Teitze Griffiss AFB, N.Y. RADC Jan. 1981 43 p
(Contract F30602-79-C-0162; AF Proj. 2338)
(AD-A096065; RADC-TR-80-401-Pt-2) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This report describes work performed from June 1979 to February 1980 to assess the utility of an EPROM threshold margin measurement concept, which minimizes the need to guarantee long term data retention in EPROM in critical military applications. In this concept, special circuitry included on-chip allows a user to periodically measure, from normal external package pins, the programmed and erased threshold margins of every cell in the array. A device possessing this special mode in its entirety was not available. However, a single vendor did incorporate (for this and other purposes) a similar function in his 16K EPROM. While this device is useful as an evaluation tool, due to its inherent inability to measure the threshold of an erased cell, it is inadequate to rigorously validate the proposed concept. An electrical characterization and an analysis of the test mode circuitry was performed on the vendor's EPROM. Results indicated the concept should be feasible at the device level. Practicality in a system application can be realized but it will be dependent on the particular circuit implementation used. Consequently, IBM-FSD recommends further investigation of the threshold measurement concept, particularly in the area of E2PROMS due to their enhanced system applicability. GRA

N81-21783# IBM Federal Systems Div., Manassas, Va.

ELECTRICAL CHARACTERIZATION OF COMPLEX MEMORIES - BYTE-WIDE STATIC RAMS, PART 1 Final Technical Report, Jun. 1979 - Sep. 1980

A. H. Taber and R. A. Moyers Jan. 1981 106 p
(Contract F30602-79-C-0162; AF Proj. 2338)
(AD-A096307; RADC-TR-80-401-Pt-1) Avail: NTIS
HC A06/MF A01 CSCL 09/2

This report describes work performed from June 1979 to September 1980 on electrical characterization of 1KX8 and 2KX8 static RAMs. The objectives of the project were to find 1KX8 and 2KX8 devices that were both attractive to the user and deliverable by industry; electrically characterize these devices; and generate a draft 38510 specification for each using characterization data as a basis for establishing performance limits. These goals were met and it was concluded that at least one company in the merchant semiconductor industry can produce 1KX8/2KX8 static RAMs that will operate over the temperature range of from -55 C case (instant on) to -125 C case (operating) with cycle times of 90/200 NS minimum, and power supply tolerances of + or - 10 percent. One of the problems encountered in establishing future performance limits was the relative newness of high speed (less than 100NS) 1KX8 RAMs and the lack of any American sKX8 static RAMs other than engineering prototypes. As a solution, performance limits for the existing parts were proposed, and limits for several faster speed grades predicted by scaling. Further work might include testing

of the enhanced speed versions of the 1KX8 and 2KX8 to justify these proposed limits. GRA

N81-21784# General Electric Co., Pleasanton, Calif. Ordnance Systems Dept.
TEST GENERATION AND FAULT ISOLATION FOR MICROPROCESSORS AND THEIR SUPPORT Final Technical Report, Jul. 1978 - Jul. 1980
Warren H. Debany, Jr., David A. OConnor, Basil K. Teague, Patricia A. Watson, and Mark S. Zemgulis Nov. 1980 191 p (Contract F30602-78-C-0235; AF Proj. 2338)
(AD-A096360; RADC-TR-80-274) Avail: NTIS HC A09/MF A01 CSCL 09/2

This report covers the generation of tests for complex digital devices, implementation of those tests on currently available ATE, and fault isolation. Techniques are described for the modeling of devices in order to facilitate the testing process. A new algorithm for fault dictionary searching is given. Voltage Contrast (on the Scanning Electron Microscope) was used as an aid for fault insertion, which in turn provided test cases for fault isolation. Computer-Aided Test techniques are described. As the demonstration vehicle for this work was the development of MIL-M-38510 Detail Specifications (Slash Sheets) a tutorial description of a recommended slash sheet format is given. Many areas were only touched on during this contract; these have been described, with suggestions for further research topics. GRA

N81-21785# California Univ., Livermore. Lawrence Livermore Lab. Transportation Systems Research Group.
CROSSLINKING OF COMPUTER TERMINALS FOR NATIONWIDE TUTORIAL INSTRUCTION
Jeffrey A. Schriebman and John E. Swanson Nov. 1980 10 p refs
(Contract W-7405-eng-48)
(UCRL-52964) Avail: NTIS HC A02/MF A01

A procedure is described for the linking of two or more terminals for demonstrating the use of new software to researchers at distant locations. This linking procedure can be used for either real-time tutorials or a classroom-type of instruction. It was implemented on a UNIX V-6 operating system. DOE

N81-21786# Department of Energy, Washington, D. C. Office of Computer Services and Telecommunications Management.
OMEGA: APPLICATION DEVELOPMENT GUIDELINES, RELEASE 2
Jan. 1979 754 p
(P881-130148; DOE/AD-0021; DOE/DF-81-005C) Avail: NTIS HC A99/MF A01 CSCL 09B

OMEGA, a generalized, interactive data entry and validation system is discussed. The OMEGA generalized data entry utility provides the link between a user's source data and the programs that must process that data. To use OMEGA's capabilities in a specific application, a set of control tables must be developed that define the characteristics of the application. Instructions of setting up an application, the information that goes into the control tables, and directions for documentation are given. GRA

N81-21787# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
REMOTE RECORD ACCESS: REQUIREMENTS, IMPLEMENTATION AND ANALYSIS Final Report
Helen M. Wood and Stephen R. Kimbleton Dec. 1980 46 p refs
(P881-137721; NBS-SP-500-71) Avail: NTIS HC A03/MF A01 CSCL 09B

Some of the problems inherent in the sharing of data among dissimilar computer and data systems are identified. Implementation issues and alternatives are presented, followed by a description of XRRA, the experimental remote record access component which was implemented as part of the Experimental Network Operating System (XNOS) at the National Bureau of Standards. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-21788# Systems Control, Inc., Palo Alto, Calif.
RESEARCH ON KNOWLEDGE BASED PROGRAMMING Trip Report, 27 Nov. 1978 - 28 Nov. 1980
Jorge Phillips Nov. 1980 5 p refs
(Contract N00014-79-C-0127; DARPA Order 3687)
(AD-A096281) Avail: NTIS HC A02/MF A01 CSCL 09/2

The following document is a report on my recent visit to several European universities and research centers. In it I will attempt two things. First, to convey personal impressions about the centers and their specific research organization. Second, to state a few general and specific observations collected during my visit, regarding computer science areas where work done at these centers may have the highest potential impact. Computer science research in Europe is of a different nature than that of the United States. While computer science work in this country concentrates on the development of advanced technologies at the boundary of basic research, similar work in Europe concentrates more on providing solutions to the everyday computational problems faced by the production sector of society (industry, government, commerce). The main difference with research in the United States thus lies in emphasis and directionality. The main emphasis of current research in the centers I visited is directed towards advanced software engineering tools (smart editors, sophisticated description languages), and computer-mediated smart communication systems both at the national level (government networking) and at the organizational level (office automation). GRA

N81-21789# Syracuse Univ., N. Y. School of Computer and Information Science.
LOGIC PROGRAMMING IN LISP, VOLUME 1 Final Report
J. A. Robinson and E. E. Silbert Griffiss AFB, N. Y. RADC Jan. 1981 136 p refs 5 Vol.
(Contract F30602-77-C-0235; AF Proj. 5581)
(AD-A096042; RADC-TR-80-379-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 09/2

The 'Language Studies' contract is divided into four project areas, all of which are directed to the problems of effectively, reliably and efficiently using modern computers in a wide range of applications. Three of the projects deal with methods of communicating with computers. Task 1. Very High Level Programming Systems (P.I: J. A. Robinson). This group is working towards combining the features developed to support work in the area of artificial intelligence and those used in general program development into a new conceptual framework that can be understood and used by a large community of users. Task 2. Proving Program Correctness (P.I: J. C. Reynolds). This group is working towards programming language designs which increase the probability that specification errors will be detected by the compiler or interpreter and to provide the language facilities so that users will more nearly be able to prove that programs perform as they are specified than is currently possible. Task 3. Grammars of Programming (P.I: E. F. Storm). This group is working towards the development of methods which will allow users to communicate with computer programs in terms of more normal to their every day communication forms. Task 4. Systems Studies (P.I: R. G. Sargent). This group is working towards developing more sophisticated and efficient models of computer systems which can predict system performance when given particular parameter values. The current efforts concern models of transaction processing systems (TPS). GRA

N81-21790# Logicon, Inc., San Diego, Calif. Tactical and Training Systems Div.
THE COMPUTER IMAGE GENERATION APPLICATIONS STUDY Final Report, Feb. 1979 - Jul. 1980
Robert K. Gullen, Charles S. Cattell, and Richard K. Overton Jul. 1980 391 p refs
(Contract F33615-79-C-3600; AF Proj. 2403)
(AD-A096235; AFWAL-TR-80-3075) Avail: NTIS HC A17/MF A01 CSCL 09/2

Computer Image Generation (CIG) systems in flight simulation

are evaluated and future trends discussed as they pertain to full mission simulation. Primary consideration is given to the research and development environment, secondary to the training environment. Recommendations are made on specifying and utilizing CIG features and capabilities. GRA

N81-21791# *Stanford Univ., Calif. Systems Optimization Lab.*

SOLUTION METHODS FOR STOCHASTIC DYNAMIC LINEAR PROGRAMS

John R. Birge Dec. 1980 139 p refs

(Contracts N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-76-81259; NSF MCS-79-26009; NSF ECS-80-12974; NSF ENG-77-06761)

(AD-A096119; SOL-80-29) Avail: NTIS HC A07/MF A01 CSCL 12/2

Linear programs have been formulated for many practical situations that require decisions made periodically through time. These dynamic linear programs often involve uncertainties. Deterministic solutions of these problems may lead to costly incorrect decisions, and, when a stochastic solution is attempted the problem may become too large. In this report, we present methods for reducing the computational cost of these stochastic programs, and we show conditions under which the stochastic program need not be solved. Our methods are based on the large-scale programming techniques of decomposition, partitioning, and basic factorization. GRA

N81-21792# Stanford Univ., Calif. Systems Optimization Lab.

TIME-STAGED LINEAR PROGRAMS

George B. Dantzig Oct. 1980 27 p refs

(Contracts N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018; DE-AT03-76EI-10601; DE-AM03-76SF-00326; DE-AT03-80EI-10682; Grants NSF MCS-76-81259; NSF MCS-79-26009; NSF ECS-80-12974; NSF ENG-77-06761)

(AD-A096120; SOL-80-28) Avail: NTIS HC A03/MF A01 CSCL 12/1

The paper outlines some procedures for solving time-staged (staircase) linear programs. Two approaches are discussed: the first based on modifying the block structure of the basis so that there are square non-singular sub-blocks along the diagonal; and the second based on the nested decomposition principle except applied to the dual system instead of the primal as proposed by Glassey and by Manne and Ho. GRA

N81-21793# Stanford Univ., Calif. Systems Optimization Lab.

EXPECTED NUMBER OF STEPS OF THE SIMPLEX METHOD FOR A LINEAR PROGRAM WITH A CONVEXITY CONSTRAINT

George B. Dantzig Oct. 1980 34 p refs

(Contracts N00014-75-C-0267; DE-AC03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-76-81259; NSF MCS-79-26009; NSF ECS-80-12974; NSF ENG-77-06761)

(AD-A096130; SOL-80-3R) Avail: NTIS HC A03/MF A01 CSCL 12/1

When there is a convexity constraint, (Sigma)(lambda sub j) = 1, each iteration t of the simplex method provides a value z sub t for the objective and also a lower bound z sub t to w sub t. The paper studies (1) the expected behavior of (w sub t/w sub 0); (2) probability of termination on the t to th iteration; and (3) the expected number of steps, xi ITER, when the columns are drawn from a distribution from a three parameter class of distributions. GRA

N81-21794# Stanford Univ., Calif. Systems Optimization Lab.

MODULES FOR USE WITH MINOS/AUGMENTED IN SOLVING SEQUENCES OF MATHEMATICAL PROGRAMMING

Paul V. Preckel Nov. 1980 23 p refs Supplement to SOL-77-9; SOL-80-14

(Contracts DAAG29-79-C-0110; N00014-75-C-0267; DE-AC03-76SE-08014; DE-AT03-76ER-72018; Grants NSF MCS-79-26009; NSF ECS-80-12974; NSF ENG-77-06761; NSF SOC-78-16811; NR Proj. 047-143)

(AD-A096131; SOL-80-15; SOL-77-9; SOL-80-14) Avail: NTIS HC A02/MF A01 CSCL 12/1

The modules documented in this report are designed for use with the nonlinear programming system MINOS/AUGMENTED when implementing algorithms requiring the solution of sequences of similar mathematical programs. Large-scale constrained mathematical programming requires the use of special data structures which make in-core problem modification difficult. These modules allow in-core modification of nonlinear programs without knowledge of the specialized data structures used in MINOS/AUGMENTED. The modifications addressed by these modules are: modification of elements in the constraint matrix, linear objective or right hand side; modification of bounds on individual variables; modification of the nonlinear functions; and appending columns to the constraint matrix. The user specifies the flow and nature of problem modifications via a FORTRAN subroutine. A simple example of the use of each of the modules is presented. GRA

N81-21795# Naval Research Lab., Washington, D. C.

A FORTRAN IV PROGRAM TO SCALE AND PLOT LOGARITHMIC AND LINEAR DATA Interim Report

T. R. ONeal 19 Mar. 1981 46 p refs

(RR0130645)

(AD-A096099; NRL-MR-4480) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report provides a general plotting routine to express 2 dimensional tabular data in logarithmic or linear graphical form. The program contains a scaling routine to maximize plot coverage and calculate axis length and tick marks. The routines are written in FORTRAN IV computer language and designed to run on a Hewlett-Packard HP 1000 computer system with Graphics 1000 plotting software and a graphics terminal or plotter. GRA

N81-21796# Science Applications, Inc., Englewood, Colo.

STUDIES IN PLAN CONSTRUCTION. 2: NOVICE DESIGN BEHAVIOR

Michael E. Atwood and Robin Jeffries (Carnegie-Mellon Univ.) Dec. 1980 54 p refs

(Contract N00014-78-C-0165; Grant RR00785; RR0420602)

(AD-A095863; SAI-80-154-DEN) Avail: NTIS HC A04/MF A01 CSCL 09/2

Software design is the process of translating a set of task requirements into a structural description of a computer program that will perform the indicated task. Expert designers rely on a great deal of domain-specific knowledge to perform a design task. Novice designers lack this specialized knowledge and rely on more general problem solving strategies. This report describes the novices: design processes and illustrates their operation by considering thinking-aloud protocols. GRA

N81-21797# Naval Training Analysis and Evaluation Group, Orlando, Fla.

COMPUTER AIDED AUTHORING AND EDITING

Richard Braby and J. Peter Kincaid Feb. 1981 14 p refs Presented at the Meeting of the Soc. for the Appl. Learning Technol., Orlando, Fla., 11 Feb. 1981

(AD-A096258; TAEG-TN-1-81) Avail: NTIS HC A02/MF A01 CSCL 05/9

Computer-aided authoring and editing are now feasible. This report describes elements of a computer-based publishing system which: creates training materials (presentations, exercises, and tests) containing both text and graphics from a limited data base, edits text for readability providing computer-generated suggestions to the author for simplifying the material, and generates camera-ready copy. The text stream and digitized graphics are used in each step above, so that they need only be entered once. A prototype system with each of these features is operating on the Training Analysis and Evaluation Group's computer. GRA

N81-21798# Bendix Field Engineering Corp., Grand Junction, Colo.

FACEDT: A FORTRAN COMPUTER PROGRAM TO PROCESS HYDROGEOCHEMICAL AND STREAM-SEDIMENT RECONNAISSANCE DATA FOR MULTIVARIATE STATISTICAL ANALYSIS

Mar. 1980 30 p

(Contract DE-AC13-76GJ-01664)
(GJBX-246(80)) Avail: NTIS HC A03/MF A01

The FACEDT program is described which compresses a rectangular N (unlimited number of samples) by M (maximum of 100 variables) array of geochemical data by eliminating missing analyses and elements containing excessive data below detection limit. This compressed clean matrix is suitable for input to multivariate statistical programs, such as those used to perform principal component, step-wise multiple regrssion, and discriminant analyses. DOE

N81-21799# California Univ., Berkeley. Energy and Environment Div.
USER INFORMATION MANUAL SUBSID: A NONLINEAR, TWO DIMENSIONAL FINITE ELEMENT PROGRAM FOR STATIC EVALUATION OF MINING SUBSIDENCE
J. L. Ratigan Jun. 1980 74 p refs
(Contract W-7405-eng-48)
(LBL-11356) Avail: NTIS HC A04/MF A01

The program SUBSID, developed to predict subsidence over a field of modified in-situ oil shale retorts under various conditions of retort backfill is described. Where subsidence must be prevented or limited, backfilling retorts can permit retort design with a higher extraction ratio than would otherwise be possible. SUBSID can be used to relate the desired increase in extraction ratio to the required structural properties of the retorts after backfilling, thus allowing costs and benfits to be balanced against each other. DOE

N81-21800# Royal Signals and Radar Establishment, Malvern (England).
PRELIMINARY IMPLEMENTATION OF POSER
S. J. Bevan London Sep. 1980 19 p refs
(RSRE-Memo-3272; BR76603) Avail: NTIS HC A02/MF A01

POSER is a process organization to simplify error recovery intended for use in fault tolerant, distributed computer systems running real time programs. The process organization used in POSER and how the organization was experimentally implemented in a multicomputer simulation are described. Application program design was studied by producing a large radar tracking program which runs on the POSER simulation. A version of the radar program exists in MASCOT and some comparisons of the two complete programs are made. Some broad comparisons of the MASCOT and POSER methods are given. Author (ESA)

N81-21801# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
THE USE OF B-SPLINE APPROXIMATION AND OF AN ARRAY PROCESSOR IN THE IRAS GROUND OPERATIONS AND PRELIMINARY ANALYSIS FACILITY
J. J. Renes and D. A. Beintema 21 Dec. 1979 22 p refs Presented at 3rd British Interplanetary Soc. (BIS) Conf. on Computers in Space Appl., Slough, England, 15-16 Nov. 1979
(NLR-MP-80009-U) Avail: NTIS HC A02/MF A01

Least squares parabolic B-spline fits of one dimensional and two dimensional data are described. Fourier analysis of the complete process as a low pass filter is presented. Nonstandard applications, such as variable weights for data and compensation for instrument response, are discussed. The algorithm, developed for processing sky brightness data of the infrared astronomical satellite project is tested by applying third order surface B-spline fitting to a LANDSAT image. About 2.5 sec of Cyber 72 time were needed for the solution and 12.5 sec for the reconstruction of the surface. Author (ESA)

N81-21802# Logica Ltd., London (England).
SOFTWARE QUALITY ASSURANCE STUDY Final Report
A. T. Arblaster, R. P. Worden, and C. D. Knight Paris ESA 31 Oct. 1980 61 p refs
(Contract ESTEC-4183/79/NL-PP(SC))
(ESA-CR(P)-1404; Rept-44-3271) Avail: NTIS HC A04/MF A01

Software quality control techniques for development, testing and maintenance of contractor-written programs were investigated. The literature on software engineering and management was examined, and the state of the art is reviewed. Current ESA quality control practices are summarized, and recommendations are made for the development of software tools. Integration of the quality control functions into the organization is discussed. Existing standards are identified for software life cycle development. The functional specification of a static analysis package is given, i.e., written in FORTRAN and interfaced through a data base system. The package monitors conformance of software with standards and the syntactic correctness of source code, provides details about test coverage achieved, and documents the source program. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N81-21803*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN APPROACH TO REAL-TIME SIMULATION USING PARALLEL PROCESSING
Richard A. Blech and Dale J. Arpasi 1981 9 p refs Proposed for presentation at the 1981 Summer Computer Simulation Conf., Washington, D.C., 15-17 Jul. 1981; sponsored by ISA and the Soc. for Computer Simulation
(NASA-TM-81731; E-787) Avail: NTIS HC A02/MF A01 CSCL 09B

A preliminary simulator design that uses a parallel computer organization to provide accuracy, portability, and low cost is presented. The hardware and software for this prototype simulator are discussed. A detailed discussion of the inter-computer data transfer mechanism is also presented. M.G.

N81-21804# National Communications System, Washington, D. C. Office of Technology and Standards.
OPEN SYSTEMS INTERCONNECTION (OSI) REFERENCE MODEL (NOVEMBER 1980) ISO DRAFT PROPOSAL (DP)7498 Final Report
George W. White Jan. 1981 107 p
(AD-A096086; AD-E100407; NCS-TIB-81-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

This TIB presents the latest version of the OSI Reference Model prepared by ISO/TC97/SC16. It has been prepared to inform federal agencies of the latest developments in the architectural structure of open (distributed) systems. Comments which would be beneficial to the furthering of this work are welcome. GRA

N81-21805# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC RECOVERY IN A REAL TIME DISTRIBUTED MULTIPLE MICROPROCESSOR COMPUTER SYSTEM M.S. Thesis
Richard Lewis Anderson Dec. 1980 156 p refs
(AD-A096339) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis presents an automatic recovery design that supports the fault-tolerant performance of a real-time, distributed, multiple microcomputer system. The recovery mechanism is structured to maintain real-time processing applications where a record of previous computations is not required and data loss is tolerable during the period of recovery. The automatic recovery technique employed is based on system reinitialization in which the system is restored to its original initialized state and then restarted. The automatic recovery mechanism has been integrated with a hierarchical, distributed operating system which supports a multiprogramming environment. A distinct address space for each system process, that is preserved by the hardware's explicit memory segmentation, in conjunction with the independent kernel and user domains of the operating system are used to facilitate dynamic relocation among identical processor modules. The result is a flexible environment that supports the dynamic reconfiguration of processors and memory during the period of reinitialization. GRA

N81-21806# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
DETERMINACY IN NETWORK MODELS: A STUDY OF STRUCTURE AND CORRELATION
J. Scott Provan and Andy S. Kydes Sep. 1980 46 p refs
(Contract DE-AC02-76CH-00016)

(BNL-51243) Avail: NTIS HC A03/MF A01

The concept of determinacy is defined in a general input output model, and is related to similar concepts in economics and linear programming. It is then applied to a particular network flow model. Special techniques are developed to detect determinacy in this model and these techniques are applied to two special classes of networks to uncover the high degree of determinacy in models of these classes. DOE

N81-21807# Fondazione Ugo Bordoni, Rome (Italy).
DATA TELEPROCESSING IN AN INTELLIGENT TERMINALS NETWORK. PART 1: GENERAL PROBLEMS [TELEPROCESSAMENTO DATI IN UNA RETE DI TERMINALI INTELLIGENTI. PARTE 1: PROBLEMI GENERALI]
Paolo Moccia, Salvatore Nicosia (Rome Univ.), and Alessandro Perugia Dec. 1979 20 p refs In ITALIAN Sponsored by Centre Nationale d'Etudes des Telecommunications 2 Vol.
(FUB-29-1979-Vol-1) Avail: NTIS HC A02/MF A01

Communication procedures between remote terminals and central processors are discussed. A general description of the computer network and some definitions are given. The functions of line protocols are examined, considering in detail the procedures for terminal interrogation, the transmitting channel assignment and the procedures for error control. Notes about interconnection topology and protocols in general are also included.
Author (ESA)

N81-21808# Fondazione Ugo Bordoni, Rome (Italy).
DATA TELEPROCESSING IN AN INTELLIGENT TERMINALS NETWORKS. PART 3: SPECIFICATIONS OF THE LINE PROTOCOL [TELEPROCESSAMENTO DATI IN UNA RETE DI TERMINALI INTELLIGENTI. PARTE 3: SPECIFICHE DEL PROTOCOLLO DI LINEA]
Paolo Moccia, Salvatore Nicosia (Rome Univ.), and Alessandro Perugia Mar. 1980 20 p refs In ITALIAN 2 Vol.
(FUB-10-1980-Vol-2) Avail: NTIS HC A02/MF A01

The functional specifications of a line protocol designed for a particular system are presented. The frame structure and field definitions, a polling and demand handling procedure, an urgent communication procedure, a normal communication procedure, and system redundancy as well as other error correcting devices are included. The problem of information loss and duplication is discussed. Author (ESA)

N81-21809# Royal Signals and Radar Establishment, Malvern (England).
INTERNETWORKING IN PACKET SWITCHED COMMUNICATIONS: FIRST REPORT ON THE ROYAL SIGNALS AND RADAR ESTABLISHMENT-ARPA COLLABORATIVE PROGRAM
B. H. Davies and A. S. Bates London Jul. 1980 34 p refs
(RSRE-Memo-3281; BR75853) Avail: NTIS HC A03/MF A01

The reliable connection of a pilot packet switched network to the ARPA Catanet system is described. How this interconnection was achieved, including the network configurations involved, the host and network protocols used, and the performance measurements obtained are given. The protocols are written for PDP/11 computers in CORAL 66 language. Performance of three types of connection on the Catenet was measured. They included (1) as a host on Arpanet, (2) as a single host network and (3) as a host on the pilot packet switched network. Performance histograms are given. The hardware and software needed by an internet user to obtain reliable, efficient and easy access to the different types of ARPA hosts are described.
Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N81-21810*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
TOWARDS SUB-OPTIMAL STOCHASTIC CONTROL OF PARTIALLY OBSERVABLE STOCHASTIC SYSTEMS
George J. Ruzicka 1980 6 p refs
(Grant NsG-4013)
(NASA-CR-164178) Avail: NTIS HC A02/MF A01 CSCL 12A

A class of multidimensional stochastic control problems with noisy data and bounded controls encountered in aerospace design is examined. The emphasis is on suboptimal design, the optimality being taken in quadratic mean sense. To that effect the problem is viewed as a stochastic version of the Lurie problem known from nonlinear control theory. The main result is a separation theorem (involving a nonlinear Kalman-like filter) suitable for Lurie-type approximations. The theorem allows for discontinuous characteristics. As a byproduct the existence of strong solutions to a class of non-Lipschitzian stochastic differential equations in dimensions is proven. M.G.

N81-21811# Syracuse Univ., N. Y. School of Computer and Information Science.
MULTIPLE FINITE SOURCE QUEUEING MODEL WITH FIXED PRIORITY SCHEDULING, VOLUME 2 Final Technical Report, 1 Oct. 1977 - 30 Sep. 1980
M. Jeya Chandra Griffiss AFB, N.Y. RADC Jan. 1981 181 p refs 5 Vol.
(Contract F30602-77-C-0235; AF Proj. 5581)
(AD-A096044; RADC-TR-80-379-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 09/2

A multiple finite source queueing model with a single server and fixed priority service discipline is investigated. Interarrival times have exponential density functions and service times have arbitrary distribution functions. A solution procedure, containing a set of numerical algorithms, is developed to obtain server utilization and the mean values of the waiting times per customer of different classes and the number of waiting customers of different classes. The imbedded Markov chain technique is used as the basic method of analysis of the model. After the elements of the transition probability matrix of the Markov Chain, P, are generated, obtaining the steady state probabilities involves inversion of a large matrix. The set of algorithms developed are extended to find time average marginal and joint probabilities of finding a certain number of waiting customers of different classes at the facility using Level Crossing Analysis. M.G.

N81-21812# Syracuse Univ., N. Y. School of Computer and Information Science.
AN ALGORITHMIC SOLUTION FOR A QUEUEING MODEL OF A COMPUTER SYSTEM WITH INTERACTIVE AND BATCH JOBS, VOLUME 3 Final Technical Report, 1 Oct. 1977 - 30 Sep. 1980
J. G. Shanthikumar and Robert G. Sargent Griffiss AFB, N.Y. RADC Jan. 1981 35 p refs 5 Vol.
(Contract F30602-77-C-0235; AF Proj. 5581)
(AD-A096043; RADC-TR-80-379-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 09/2

A queueing model with two customer classes, one with infinite and the other with finite source, is used as a model for a computer system with interactive and batch jobs. Using an imbedded Markov Chain representation of this queueing system, and an algorithmic approach, the steady state joint probability distribution of the number of interactive and batch jobs at a job service completion epoch is derived. Server utilization, mean waiting times, joint probability distribution, and mean number of interactive and batch jobs at an arbitrary time epoch are derived using these probabilities, discrete state level crossing analysis, and Little's result. M.G.

N81-21813# Maryland Univ., College Park. Computer Vision Lab.
MULTISPECTRAL TEXTURE
Azriel Rosenfeld, Cheng-Ye Wang, and Angela Y. Wu Dec. 1980 16 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A096409; TR-988; AFOSR-81-0144TR) Avail: NTIS HC A02/MF A01 CSCL 05/8

Textures in single-band images are often characterized by statistics of the joint distributions of pairs of gray levels for pairs of pixels in given relative positions, or by statistics of absolute gray level differences for such pairs of pixels. Joint

distributions of pairs of spectral vectors in multiband images are cumbersome, since for k bands they are 2k-dimensional; but absolute difference distributions are less e.g., for two bands they are only two-dimensional. This paper discusses the possibility of using statistics of absolute difference distributions for characterizing textures in multiband images, with emphasis on the two-band case. GRA

N81-21814# Maryland Univ., College Park. Computer Vision Lab.

IMAGE PROCESSING ON ZMOB

Todd Kushner, Angela Y. Wu, and Azriel Rosenfeld Dec. 1980 35 p ref

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A096410; TR-987; AFOSR-81-0143TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

ZMOB is a multi-microprocessor system consisting of 256 Z80A microprocessors that communicate via a fast cyclic shift-register bus. This paper discusses the efficient use of ZMOB for various types of image processing operations, including point and local operations, discrete transforms, geometric operations, and computation of image statistics. GRA

N81-21815# Maryland Univ., College Park. Computer Vision Lab.

FITTING MARKOV RANDOM FIELD MODELS TO IMAGES Interim Report

R. Chellappa Jan. 1981 41 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A095857; TR-994; AFOSR-81-0142TR) Avail: NTIS HC A03/MF A01 CSCL 05/8

We are interested in fitting two-dimensional, Gaussian conditional Markov random field (CMRF) models to images. The given finite image is assumed to be represented on a finite lattice of specific structure, obeying a CMRF model driven by correlated noise. The stochastic model is characterized by a set of unknown parameters. We describe two sets of experimental results. First, by assigning values to parameters in the stationary range, two-dimensional patterns are generated. It appears that quite a variety of patterns can be generated. Next, we consider the problem of estimating the unknown parameters of a given model for an image, and suggest a consistent estimation scheme. We also implement a decision rule to choose an appropriate CMRF model from a class of such competing models. The usefulness of the estimation scheme and the decision rule to choose an appropriate model is illustrated by application to synthetic patterns. Unilateral approximations to CMRF models are also discussed. GRA

N81-21816# Maryland Univ., College Park. Computer Vision Lab.

APPROXIMATION OF POINT-SET IMAGES BY PLANE CURVES Interim Report

Philip R. Thrift Dec. 1980 16 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A095973; TR-986; AFOSR-81-0141TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

A transform method is presented for detecting elements of a parametric family of curves in noisy point-set images. Local maxima of the transform in the parameters space will correspond to best approximations to parts of the data. The cases of linear, circular, and parabolic approximations are discussed. GRA

N81-21817# Naval Postgraduate School, Monterey, Calif.

OPTIMAL CONTROL SYSTEM DESIGN WITH PRESCRIBED EIGENVALUES VIA CAUER SECOND FORM M.S. Thesis

Edward J. Stanley, Jr. Sep. 1980 156 p refs

(AD-A096371) Avail: NTIS HC A08/MF A01 CSCL 12/2

A method is developed in terms of the Cauer Second Form representation of continued fractions as a means of designing linear single-input-output (SISO) control systems. Optimal closed loop solutions corresponding to a set of prescribed eigenvalues are obtained through minimization of a quadratic performance index. The partitioning method of the Cauer Second Form for system simplification is presented with a simplified inversion technique for the reduced order system. GRA

N81-21818# Naval Postgraduate School, Monterey, Calif.

ADAPTIVE IMAGE PROCESSING AND IMPLEMENTATION BY MULTIPLE MICROCOMPUTER SYSTEM Ph.D. Thesis

Haim Amir (Israeli Navy) Dec. 1980 265 p refs

(AD-A096384) Avail: NTIS HC A12/MF A01 CSCL 05/8

This thesis has two parts, both related to the development of smart sensor systems. The first part is a theoretical development of two families of adaptive spatial filters for suppressing background clutters in infrared images and based on the minimization of mean squared error or the maximization of signal to noise ratio criterion. Seven different nonlinear search techniques have been developed for the adaptation process. They have been applied to two real world infrared test images and exhibit fast convergence rate with no misadjustment. The second part is an experimental development of a multiple microcomputer system which can be a candidate for an on-board processor system. A multiple star, multiple cluster architecture was developed whose intercommunication is managed by a three-level control including central controller, distributed controller and random priority controller. The adaptive spatial filter has been successfully implemented on this system using partitioning for parallel computing. GRA

N81-21819# Delaware Univ., Newark. Applied Mathematics Inst.

OPERATOR-GEOMETRIC STATIONARY DISTRIBUTIVE FOR MARKOV CHAINS, WITH APPLICATION TO QUEUEING MODELS Interim Report

R. L. Tweedie (CSIRO) Dec. 1980 37 p refs

(Grants AF-AFOSR-3236-77; NSF ENG-79-08351; AF Proj. 2304)

(AD-A096030; AFOSR-81-0135TR; TR-688) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers a class of Markov chains on a bivariate state space (N,E), whose transition probabilities have a particular 'block-partitioned' structure. Examples of such chains include those studied by Neuts (1978) who took E to be finite: they also include chains studied in queueing theory, such as (Nn, Sn) where Nn is the number of customers in a GI/G/1 queue immediately before, and Sn the remaining service time immediately after, the nth arrival. We show that the stationary distribution for these chains has an 'operator-geometric' nature where the operator S is the mininal solution of a non-linear operator equation. Necessary and sufficient conditions for Pi to exist are also found. In the case of the GI/G/1 queueing chain above these are exactly the usual stability conditions. GRA

N81-21820# Fraunhofer-Inst. fuer Informations- und Datenverarbeitung, Karlsruhe (West Germany).

CURRENT STATE OF RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF PATTERN RECOGNITION IN THE FEDERAL REPUBLIC OF GERMANY Final Report

M. Bohner, H. Kazmierczak, H. Tropf, and G. Winkler Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 112 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Forschungsinstitut fuer Informationsverarbeitung

(BMFT-FB-DV-80-003; ISSN-0170-9011) Avail: NTIS HC A06/MF A01

Research is described in remote sensing, speech and language analysis, character recognition, acoustics, biomedical analysis, and industrial and military orientated applications. The implementation of the various procedures developed is exposed, emphasis being given to the equipment used and the acquisition and processing of the data obtained. Author (ESA)

N81-21821# Oxford Univ. (England). Dept. of Engineering Science.

ON NONLINEAR ADAPTIVE CONTROL

O. L. R. Jacobs 1980 31 p refs

(OUEL-1323/80) Avail: NTIS HC A03/MF A01

The performance and practical implementation of a general purpose algorithm for adaptive control is discussed. Results from a Monte Carlo simulation, a laboratory implementation, and a full-scale industrial case study, are assembled. Performance of the algorithm is compared to performance of classical feedback control, of selftuning control, and of best and worst bounds on

adaptive performance. When adaptive control is necessary is analyzed. The use of prior information to tune and initiate the algorithm, which makes greater use of available information and is thus more complex than others, is described. Author (ESA)

N81-21822# Engins Matra, Velizy (France). Lab. de Traitement des Images.

DATA RATE REDUCTION, VOLUME 1

Gabriel E. Lowitz and Jean M. Vivier Paris ESA Jul. 1980 59 p refs 4 Vol.

(Contract ESTEC-3749/78/NL-HP)

(ESA-CR(P)-1387-Vol-1) Avail: NTIS HC A04/MF A01

Supervised classification of multispectral image data by the maximum likelihood test is discussed, and a fast maximum likelihood Gaussian classification algorithm is described. The algorithm is developed in order to provide an efficient tool in assessing the performances of classification algorithms applied to compressed and decompressed data in comparison with the performances of the same algorithms used on raw data.

Author (ESA)

N81-21823# Engins Matra, Velizy (France). Lab. de Traitement des Images.

DATA RATE REDUCTION. VOLUME 2: IMPLEMENTATION OF THE DURHAM TEXTURE ALGORITHM ON RAW AND COMPRESSED DATA OF ISPAHAN SCENE

Gabriel E. Lowitz and Jean M. Vivier Paris ESA Jul. 1980 48 p refs 4 Vol.

(Contract ESTEC-3749/78/NL-HP)

(ESA-CR(P)-1387-Vol-2) Avail: NTIS HC A04/MF A01

Classification experiments on raw and compressed multispectral data were conducted in order to test the robustness of a clustering compression concept. The clustering compression algorithm groups the multispectral pixels of a data block (a 512 pixels line) into 16 classes, using a maximum likelihood estimate, minimization criterion. After the grouping the pixels are replaced by the barycenter of the class. Texture analysis software, developed for geographical surveys, was applied to a LANDSAT scene. The digital simulation shows that texture information as good on decompressed data as on raw data can be retrieved. Author (ESA)

N81-21824# Engins Matra, Velizy (France). Lab. de Traitement des Images.

DATA RATE REDUCTION. VOLUME 3: CASCADED CLUSTERING OF COMPRESSED MULTISPECTRAL IMAGE DATA

Gabriel E. Lowitz and Jean M. Vivier Paris ESA Jul. 1980 57 p refs 4 Vol.

(Contract ESTEC-3749/78/NL-HP)

(ESA-CR(P)-1387-Vol-3) Avail: NTIS HC A04/MF A01

A cascaded, clustering strategy which provides a globally shorter description of digital pictorial data with respect to the number of different multispectral vectors contained in a given frame of imagery is proposed. The implementation of cascaded clustering was studied. Cascaded clustering as well as pictorial reconstruction results demonstrate that affecting cascaded clustering by a hierarchical method preserves the image dynamic range and subjective fidelity of reconstruction. Next, this form of preprocessing was validated for supervised classification. A maximum likelihood supervised classification was performed on multispectral data. The results were compared with those obtained from both the raw data and the compressed data. On cascaded cluster data or on compressed data, the classification results are better than on raw data. Author (ESA)

N81-21825# Logica Ltd., London (England).

IMAGE DATA COMPRESSION EXPERIMENT REPORT. VOLUME 4: THE EFFECT OF IMAGE DATA COMPRESSION ON A PARALLELEPIPED CLASSIFIER

David J. Stanley Paris ESA Aug. 1980 28 p refs 4 Vol.

(Contract ESA-3749/78/NL-HP)

(ESA-CR(P)-1387-Vol-4) Avail: NTIS HC A03/MF A01

Irreversible data compression by cluster coding each line of raster scanned multispectral images is proposed for onboard reduction of telemetry data rates from European remote sensing satellites. Although changes to the data structure are small in terms of rms error, certain types of interpretation technique can be particularly sensitive. Simulation is one of the best ways of evaluating this interaction, and the results of a brief investigation of parallelepiped classification applied to data on an interactive facility is described. Results are satisfactory for field classification on both raw channels and principal components except where class distributions overlapped. In some cases, results on the reconstructed image data are better because of the smoothing effect of a reduction in intra-class variance. Author (ESA)

N81-21826# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

TIMETABLES FOR DENTAL STUDENTS

J. M. Anthonisse, B. J. Lageweg, and B. vanRij (Netherlands Dept for Land and Water Use, Utrecht) May 1980 27 p refs Submitted for publication

(MC-BW-124/80) Avail: NTIS HC A03/MF A01

A timetabling problem for the practical work which is to be performed by dental students is considered. At the beginning of the academic year each student receives an individual timetable, indicating his activities for the entire year. The timetables have to observe several types of requirements, such as capacity, frequency and precedence constraints. Moreover the capacity of one particular practicum should be equally distributed over the students, leaving as little spare capacity as possible. The time-tabling problem is decomposed into a series of sequencing problems which are solved by heuristic methods. A set of FORTRAN programs was written to store, retrieve, modify and print the individual time tables and related surveys. This approach allows for a large degree of flexibility in case of course changes. Author (ESA)

N81-21827# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

AN INTRODUCTION TO THE SCHEDULING OF SEVERAL MACHINES [INTRODUCTION A L'ORDONNANCEMENT DE PLUSIEURS MACHINES]

J. K. Lenstra and A. H. G. Rinnooykan (Erasmus Univ., Rotterdam) Aug. 1980 20 p refs In FRENCH Presented at Colloq. Regards sur la Theorie des Graphes, Cerisy-la-Salle, France, 12-19 Jun. 1980 Submitted for publication

(Grant NATO-9.2.02(SRG.7))

(MC-BW-126/80) Avail: NTIS HC A02/MF A01

A synthesis of recent results concerning the optimal sequencing of jobs on several machines is presented. The theory of computational complexity for combinatorial problems is briefly introducted. Basic sequencing models for job scheduling on parallel machines are reviewed. The inclusion is of unitary completion times and precedence constraints on job scheduling is emphasized. The resultant model is further extended to cover the possibility of preempting (interrupting a job) and the arbitrary setting of release dates. Polynomial algorithms for solving these deterministic sequencing and scheduling problems are mentioned, and application of the concept NP-hard along with analyses of approximation algorithms is discussed. Author (ESA)

N81-21828# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

PREEMPTIVE SCHEDULING OF A SINGLE MACHINE TO MINIMIZE MAXIMUM COST SUBJECT TO RELEASE DATES AND PRECEDANCE CONSTRAINTS

K. R. Baker (Dartmouth Coll.), E. L. Lawler (California Univ., Berkeley), J. K. Lenstra, and A. H. G. Rinnooykan (Erasmus Univ., Rotterdam) Aug. 1980 10 p refs Submitted for publication (Grant NSF MCS-78-20054)

(MC-BW-128/80) Avail: NTIS HC A02/MF A01

Algorithms for the optimal sequencing of jobs on a single machine, subject to priority constraints, are developed. A preemptive schedule which minimizes the maximum job completion cost is sought. An o (n squared) algorithm for this problem, generalizing previous results, is offered. A numerical example is presented, and it is shown that if all release dates are equal, there is no advantage to preemption and the problem is solvable in o (n squared) time. The problem is still solvable in o (n squared) time if the release dates are arbitrary. However, the nonpreemptive case is unary NP-hard in the strong sense, even without precedence constraints. Author (ESA)

N81-21829# Purdue Univ., Lafayette, Ind. School of Industrial Engineering.
CAN-Q (COMPUTER ANALYSIS OF NETWORKS OF QUEUES) USER'S GUIDE. THE OPTIMAL PLANNING OF COMPUTERIZED MANUFACTURING SYSTEMS
James J. Solberg Jul. 1980 50 p refs
(Grant NSF APR-74-15256)
(PB81-132078; NSF/RA-800226; Rept-9) Avail: NTIS HC A03/MF A01 CSCL 13H

Instructions for using the most recent FORTRAN version of Computer Analysis of Networks of Queues (CAN-Q) are given. CAN-Q is a mathematical model for analyzing work flow in a production system. The program has been tested thoroughly using both real and simulated data. The User's Guide describes CAN-Q, defines terms, and illustrates the application of CAN-Q to a system which includes three stations (work places) producing only two product types. Interpretation of the output indicates what to expect, provide, and receive from the program. Also, input formats are presented with directions for solving handling problems. A CAN-Q bibliography and program listing are included. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-21830*# Flow Simulations, Inc., Sunnyville, Calif.
A PRELIMINARY STUDY OF RELAXATION METHODS FOR THE INVISCID CONSERVATIVE GASDYNAMICS EQUATIONS USING FLUX SPLITTING Final Report
Joseph L. Steger Washington NASA Mar. 1981 56 p refs
(Contract NAS1-15852)
(NASA-CR-3415; FSI-80-4) Avail: NTIS HC A04/MF A01 CSCL 12A

Plus minus flux vector split schemes are combined with the multigrid relaxation method to obtain fast rates of iterative (or steady state) convergence. On model nonlifting biconvex airfoil flow, steady state convergence is obtained using multigrid in 40 iteractions for subsonic cases and in 120 iterations for transonic cases. A 65 x 33 stretched grid is used. However, the multigrid scheme used here (and there are numerous variations) sometimes could not be made to work for transonic cases with a large number of supersonic points. Moreover, the multigrid method is only several times faster than the conventional algorithm which itself could perhaps be accelerated by other means. Nethertheless, with proper adjustment the multigrid method will ultimately lead to very fast rates of iterative convergence. M.G.

N81-21831*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SOLUTION FOR TWO-DIMENSIONAL FREDHOLM INTEGRAL EQUATIONS OF THE SECOND KIND WITH PERIODIC, SEMIPERIODIC, OR NONPERIODIC KERNELS
Ralph E. Gabrielsen and Aynur Uenal (Stanford Univ., Calif.) Apr. 1981 31 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
(NASA-TM-81249; A-8410; USAAVRADCOM-TR-81-A-4) Avail: NTIS HC A03/MF A01 CSCL 12A

A numerical scheme for solving two dimensional Fredholm integral equations of the second kind is developed. The proof of the convergence of the numerical scheme is shown for three cases: the case of periodic kernels, the case of semiperiodic kernels, and the case of nonperiodic kernels. Applications to the incompressible, stationary Navier-Stokes problem are of primary interest. M.G.

N81-21832*# Old Dominion Univ., Norfolk, Va.
TWO-DIMENSIONAL INTEGRATING MATRICES ON RECTANGULAR GRIDS Final Contractor Report, 15 May - 1 Sep. 1980
W. D. Lakin Feb. 1981 23 p refs
(Contract NAS1-15648)
(NASA-CR-165668) Avail: NTIS HC A02/MF A01 CSCL 12A

The use of integrating matrices in solving differential equations associated with rotating beam configurations is examined. In vibration problems, by expressing the equations of motion of the beam in matrix notation, utilizing the integrating matrix as an operator, and applying the boundary conditions, the spatial dependence is removed from the governing partial differential equations and the resulting ordinary differential equations can be cast into standard eigenvalue form. Integrating matrices are derived based on two dimensional rectangular grids with arbitrary grid spacings allowed in one direction. The derivation of higher dimensional integrating matrices is the initial step in the generalization of the integrating matrix methodology to vibration and stability problems involving plates and shells. M.G.

N81-21833# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistic Research Lab.
DIFFUSION EQUATION SOLUTION SEQUENCES Final Report
John F. Polk Jan. 1981 48 p ref
(DA Proj. 1L1-61102-AH-43)
(AD-A096194; AD-E430572; ARBRL-TR-02281) Avail: NTIS HC A03/MF A01 CSCL 12/1

A methodology is described for deriving expansions for the solutions of parabolic differential equations which are asymptotically valid for small times. Both the Cauchy problem and the first initial-boundary value problem are studied and particular attention is given to cases in which the data is discontinuous or incompatible with the equation. The basic procedure is called DESS (Diffusion Equation Solution Sequence) method and all expansions are obtained in explicit form using certain special functions which are briefly discussed. Error estimates are rigorously stated but their proofs are not included in the present work. GRA

N81-21834# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Automatic Data Processing Center.
DOCUMENTATION OF FINITE ELEMENT ANALYSES. REPORT 1: LONGVIEW OUTLET WORKS CONDUIT
Richard Huff and Chris A. Merrill Dec. 1980 92 p
(AD-A096364; WES-TR-K-80-4-1) Avail: NTIS HC A05/MF A01 CSCL 13/13

The Longview Outlet Works Conduit is a reinforced concrete structure containing a flood control passageway located above two sewer passageways. A finite element analysis was made to determine stresses in the conduit. From these stresses, the moment, thrust, and shear forces were developed. The analysis was made using the GTICES STRUDL II Program available in the Boeing Computer System. A plane strain finite element analysis was performed. To become familiar with the finite element method and to confirm procedures used, example problems with known solutions were analyzed using the finite element method and the results were compared to the results from a conventional analysis. The examples problems were a simple beam and a circular conduit. Selected results from the example problems are included. These example problems provided guidance in selecting the element grid for the conduit analysis. Two finite element models were used in the conduit analysis: one model was of the structure only, and the other was for the structure and a portion of the foundation. The analysis evaluated the structure under the following three foundation conditions: rigid base, foundation modeled, and uniform base pressure. The results of this study indicated that the stresses were usually bracketed by the rigid base and the uniform base pressure foundation conditions. GRA

N81-21835# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE UNIQUENESS OF A MULTI-DIMENSIONAL SEQUENCE IN TERMS OF ITS PHASE OF MAGNITUDE
Monson H. Hayes 11 Dec. 1980 37 p refs
(Contract F19628-80-C-0002; AF Proj. 4594)
(AD-A095953; TR-544; ESD-TR-80-234) Avail: NTIS HC A03/MF A01 CSCL 12/1

A multi-dimensional sequence is not, in general, uniquely defined in terms of only the phase or magnitude of its Fourier transform. However, in this paper some conditions are developed under which a multi-dimensional sequence is uniquely defined by its phase. A similar set of conditions are then developed for the unique specification of a multi-dimensional sequence in terms

of its Fourier transform magnitude. In both cases, it is initially assumed that either the phase or magnitude is known for all frequencies. The results are then generalized to the case in which the phase or magnitude is known only for a finite set of frequency values. GRA

N81-21836# Stanford Univ., Calif. Dept. of Computer Science.
REFINED ANALYSIS AND IMPROVEMENTS ON SOME FACTORING ALGORITHMS
C. P. Schnorr (Frankfurt Univ.) Nov. 1980 33 p refs
(Contract N00039-80-C-0132; Grant NSF MCS-77-23728; ARPA Order 3889)
(AD-A096348; SU-STAN-CS-80-825) Avail: NTIS HC A03/MF A01 CSCL 12/1

By combining the principles of known factoring algorithms we obtain some improved algorithms which by heuristic arguments all have a time bound O(exp sq. root of (cln n ln ln n) for various constants c greater than or equal to 3. In particular, Miller's method of solving index equations and Shanks method of computing ambiguous quadratic forms with determinant -n can be modified in this way. We show how to speed up the factorization of n by using preprocessed lists of those numbers in (-u, u) and (n - u, n + u), 0 + + u + + n which only have small prime factors. These lists can be uniformly used for the factorization of all numbers in (n - u, n + u). Given these lists, factorization tasks O(exp (2(ln n)(to the 1/3 power)(ln ln n) to the 2/3 power)) steps. We slightly improve Dixon's rigorous analysis of his Monte Carlo factoring algorithm. We prove that this algorithm with probability 1/2 detects a proper factor of every composite n within O(exp sq. root of (6ln n ln ln n) steps. GRA

N81-21837# South Carolina Univ., Columbia. Dept. of Mathematics and Statistics.
A SYMPTOTIC BEHAVIOR OF SOLUTIONS TO THE DAMPED QUASILINEAR EQUATION Interim Report
Frederick Bloom 1981 15 p refs
(Grant AF-AFOSR-3396-77; AF Proj. 2304)
(AD-A096402; AFOSR-81-0215TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Asymptotic lower bounds for the L2 norms of solutions of initial-boundary value problems associated with the equation of the title are derived for a simple case in which the equation fails to exhibit strict hyperbolicity. It is shown that in such cases the norm of a solution will be bounded away from zero as t approaches infinity even as the damping factor gamma becomes infinitely large. GRA

N81-21838# South Carolina Univ., Columbia. Dept. of Mathematics and Statistics.
ON THE DAMPED NONLINEAR EVOLUTION EQUATION W SUB TT = SIGMA (W) SUB XX - GAMMA W SUB T
Frederick Bloom 30 Jan. 1981 48 p refs
(Grant AF-AFOSR-3396-77; AF Proj. 2304)
(AD-A095866; AFOSR-81-0182TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The damped nonlinear wave equation W(tt) = sigma(W)(xx) minus gamma W(T) is formally equivalent to a quasilinear system of the form (W(t) - V(x) = 0) and (V(t) minus sigma (W)(x) + gamma V = 0) which arises, in particular, in models of shearing flow in a nonlinear viscoelastic fluid. In such models, it has been shown that when the system is strictly hyperbolic, i.e., sigma primed (0) = 0 and the initial data is small (so that sigma primed (W) = 0 for as long as solutions exist) smooth solutions will fail to exist globally in time if the gradients of the initial data are too large. In this paper, we show that similar results hold if sigma primed (0) = 0 or if sigma primed (zeta) + 0 for absolute value of zeta sufficiently large; we also derive growth estimates for the L(2) norm of a maximally-defined smooth solution. GRA

N81-21839# Southern Methodist Univ., Dallas, Tex. Dept. of Mathematics.
NUMERICAL METHODS FOR BOUNDARY VALUE PROBLEMS Final Report, Jun. 1978 - Dec. 1980
G. W. Reddien and E. J. Doedel 17 Feb. 1981 5 p refs
(Contract DAAG29-80-C-0039; Grant DAAG29-78-G-0126; DA Proj. 1L1-61102-BH-57)
(AD-A095959; ARO-15673.4-M; ARO-17146.1-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Collocation discretizations of two-point boundary value problems, including parameter dependent problems, are studied. Stability of certain discretizations is established, and their use for the computation of bifurcation diagrams, including the Hopf case, is investigated. Efficient reparameterizations for Hopf problems to allow computation around turning points are also given. GRA

N81-21840# Wisconsin Univ. - Madison. Dept. of Computer Sciences.
A COMPLETE ANALYSIS OF A MODEL NONLINEAR SINGULAR PERTURBATION PROBLEM HAVING A CONTINUOUS LOCUS OF SINGULAR POINTS
Nancy Kopell and Seymour V. Parter Jan. 1981 37 p refs
(Contracts N00014-76-C-0341; DAAG29-80-C-0041; Grant NSF MCS-77-03715)
(AD-A096323; CSTR-404) Avail: NTIS HC A03/MF A01 CSCL 12/1

Consider the boundary value problem epsilon y double prime = (y sq - t sq) y:, -1 < t < 0, y(-1) = A, y(0) = B. Depending on the choice of A and B, one can insure the existence of 'turning points'. However, due to the nonlinear nature of the problem, one does not know the position or number of such turning points. In the case when A > 0 = B Kedem, Parter and Steuerwalt gave a development of this problem based on an abstract bifurcation analysis which in turn was based on 'degree theory'. In this paper we give a complete analysis of the problem based entirely on a-priori estimates and the 'shooting' method. GRA

N81-21841# Naval Research Lab., Washington, D. C.
A FORTRAN COMPUTER PROGRAM FOR CALCULATING THE PROLATE SPHEROIDAL ANGULAR FUNCTIONS OF THE FIRST KIND
B. J. Patz and A. L. VanBuren 13 Mar. 1981 43 p refs
(RR0110842)
(AD-A095922; NRL-MR-4414) Avail: NTIS HC A03/MF A01 CSCL 12/1

The Helmholtz wave equation (sq del + sq K) psi = 0 is separable in prolate spheroidal coordinates (eta, xi, psi) with the solution psi = R(c, xi)S(c, eta)Phi(phi). Here c = ka/2, where a is the interfocal distance. A computer program called PANGFN has been developed to numerically evaluate in double-precision arithmetic the angular function of the first kind S(ml)(1) (c, eta) for any desired values of c, m, l, and the argument Theta = ARCCCOS(eta). The program is written in universal FORTRAN and should run on any computer that accepts this language. Special techniques are used to avoid overflow and underflow problems. By the use of logarithms, PANGFN can compute the angular function even when its value exceeds the exponent range of the computer. This report describes the principle features of PANGFN. Included are discussions of the significant FORTRAN variable names, dimensions and storage, parameter input, parameter ranges, computational procedure, computation time, printed output, and accuracy of the results. A sample output and a computer listing of LINPRO are attached as appendices. GRA

N81-21842# Sandia Labs., Albuquerque, N. Mex.
OPTIMAL PARAMETERS FOR LINEAR SECOND-DEGREE STATIONARY ITERATIVE METHODS
Thomas A. Manteuffel Nov. 1980 17 p refs Sponsored by DOE
(SAND-80-2371) Avail: NTIS HC A02/MF A01

It is shown that the optimal parameters for linear second-degree stationary iterative methods applied to nonsymmetric linear systems can be found by solving the same minimax problem used to find optimal parameters for the Tchebychev iteration. In fact, the Tchebychev iteration is asymptotically equivalent to a linear second-degree stationary method. Other methods of finding optimal parameters for the Tchebychev iteration can be used to find optimal parameters for the stationary method as well. M.G.

N81-21843# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
ON THE ADEQUACY OF FINITE EQUATIONAL METHODS FOR DATA TYPE SPECIFICATION
J. A. Bergstra (Leiden Univ., Netherlands) and J. V. Tucker Dec. 1979 9 p refs Submitted for publication
(MC-IW-127/79) Avail: NTIS HC A02/MF A01

Theoretical considerations into the adequacy of equational techniques for writing data type specification code, pioneered in the literature of programming methodology, are discussed. The initial algebra approach to the specification, correctness and implementation of abstract data types is emphasized. Algebraic data types and data structures are defined. Equational specifications with hidden functions and with hidden sorts are also discussed. A semantic measure of adequacy is given based on the concepts of finite, computable, and semicomputable algebras. Author (ESA)

N81-21844# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Dept.
B-SPLINE APPROXIMATION. BACKGROUND AND ALGORITHMS
J. J. Renes 10 Aug. 1980 13 p refs Presented at Workshop on Appl. of Image Processing in Astron., Triest, 4-8 Jun. 1979
(NLR-MP-79046-U) Avail: NTIS HC A02/MF A01

The use of the B-spline approximation in one and two dimensions for compression and analysis of large datasets is described. Emphasis is on quick-look data processing for the Infrared Astronomical Satellite (IRAS). Unit spaced splines, general splines and surface splines are reviewed. Least squares B-spline fitting is mentioned and applications of unit spaced B-spline fitting of long data streams and general B-spline fitting for smaller problems are shown. On a Cyber 72 computer a B-spline treatment of a LANDSAT image took 13.2, 3.3, and 13.1 sec of central processor time for correlation, deconvolution, and reconstruction steps respectively. Author (ESA)

N81-21845# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A RANK BAYESIAN POSTERIOR ANALYSIS FOR SEGMENTED STRAIGHT LINE REGRESSION MODELS INVOLVING AN UNKNOWN CHANGE-POINT
A. N. Pettitt Nov. 1979 24 p refs
(Maths-Res-144) Avail: NTIS HC A02/MF A01

Segmented straight line regression models involving an unknown change-point are considered in order to explain the variation in response of a variable which can only be observed in ranked form. The analysis is carried out using a rank Bayesian model; posterior distributions for the change-point are found which involve normal scores rank statistics. Posterior odds ratios for association against no association between the response and the independent variable are also found involving ranks of the observations only. Illustrations of where the technique might be useful are given together with details of numerical examples. Author (ESA)

N81-21846# Fondazione Ugo Bordoni, Rome (Italy).
COMPUTATION OF MINIMUM COST MULTICOMMODITY FLOW IN A GRAPH [CALCOLO DI UN FLUSSO MULTICOMMODITY DI COSTO MINIMO IN UN GRAFO]
Giancarlo Pesamosca Jun. 1980 32 p refs In ITALIAN
(FUB-15-1980) Avail: NTIS HC A03/MF A01

A method using an algorithm for computation of minimum cost multicommodity flow based on elimination of negative cost elementary circuits is presented. The algorithm is valid also for graphs having ares with noncontinuous capacity or cost functions, but an absolute minimum does not always exist, except for the case of convex functions, or in the absence of capacity requirements. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-21847# California Univ., Berkeley. Statistical Lab.
INTRODUCTION TO THE ENGLISH TRANSLATION OF THE MARKOV/CHUPROV CORRESPONDENCE
Jerzy Neyman and H. O. Ondar, ed. Feb. 1981 9 p
(Contracts N00014-75-C-0159; DAAG29-79-C-0093)
(AD-A096009; CU-SL-81-01-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A collection of letters by A. Markov and A. A. Chuprov exchanged before 1913 is presented. In that year the Imperial Academy of Sciences in Moscow celebrated the bicentenary of the law of large numbers symbolized by Ars Conjectandi: the work of Jacob Bernoulli, the Markov/Chuprov correspondence, combined with some other material, provides an interesting perspective on the early history of the modern theory of probability. GRA

N81-21848# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
GENERAL CONSTRUCTIVE THEORY OF PARAMETRIC AND ROBUST DATA SMOOTHERS Interim Report
P. Papantoni-Kazakos Dec. 1980 33 p refs
(Grant AF-AFOSR-3695-78)
(AD-A096004; EECS-TR-80-11; AFOSR-81-0134TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In relatively recent years, several algorithms for smoothing of time series have been proposed by statisticians. Some of the simpler such algorithms have been also applied in several engineering applications such as Image Processing. The smoothing problem and the implied objective have not been formalized and stated, however. This fact presents a serious handicap when different smoothing algorithms are to be compared in terms of their performance. In this paper, we take a fresh and daring approach to the whole smoothing problem. We formalize the problem as the extraction of a low entropy process from a high entropy process, and as a result we present a constructive theory of parametric and robust data smoothers. We claim that parametric data smoothers are analog-to-digital converters, and that robust data smoothers are stochastic such converters. GRA

N81-21849# Pittsburg Univ., Pa. Dept. of Mathematics and Statistics.
A DECOMPOSITION FOR MULTISTATE MONOTONE SYSTEMS
Henry W. Block and Thomas H. Savits Jan. 1981 20 p refs
(Contract N00014-76-C-0839; Grant NSF MCS-77-01458)
(AD-A096071; RR-81-02) Avail: NTIS HC A02/MF A01 CSCL 12/1

A decomposition theorem for multistate structure functions is proven. This result is applied to obtain bounds for the system performance function. Another application is made to interpret the multistate structures of Barlow and Wu. Various concepts of multistate importance and coherence are also discussed. GRA

N81-21850# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
NONPARAMETRIC PROCEDURES IN MULTIPLE DECISIONS (RANKING AND SELECTION PROCEDURES)
Shanti S. Gupta and Gary C. McDonald (General Motors Research Labs.) May 1980 33 p refs Presented at the Colloq. on Nonparametric Statist. Inference, Budapest, 23-28 Jun. 1980
(Contract N00014-75-C-0455)
(AD-A096093; MMS-80-13) Avail: NTIS HC A03/MF A01 CSCL 12/1

This article surveys statistical techniques which are nonparametric in nature and used in formal ranking and selection of populations. Such methods have been developed only within the last fifteen years and are usually based on rank scores and/or robust estimators (such as the Hodges-Lehmann estimator). The procedures surveyed are applicable to one-way classifications, two-way classifications, and paired-comparison models. Computational methods, useful inequalities, and appropriate numerical tables required to implement these techniques are identified and discussed. Asymptotic relative efficiencies of the nonparametric methods, compared to their parametric counterparts, are presented. Specific applications of these methods (such as traffic fatality rates) are mentioned and areas for further theoretical and computational research are identified. GRA

N81-21851# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON GAMMA-MINIMAX, MINIMAX AND BAYES PROCEDURES FOR SELECTING POPULATIONS CLOSE TO A CONTROL
Shanti S. Gupta and Ping Hsiao Apr. 1980 36 p refs
(Contract N00014-75-C-0455)
(AD-A096094; MMS-80-9) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let Pi sub 0, Pi sub 1,...,Pi sub k be (k-1) normally distributed populations and let Pi sub 0 be a control population. Our goal is to select those populations which are sufficiently close to the control in terms of the (unknown) means of the populations. A zero-one type loss function is defined. Gamma-minimax rules, Bayes rules and minimax rules are derived for this problem and compared. Some optimal properties of Gamma-minimax rules are shown; also Gamma-minimax rules are derived for distributions other than the normal. GRA

N81-21852# South Carolina Univ., Columbia. Dept. of Mathematics.
ESTIMATION OF LOCATION DIFFERENCE FOR FRAGMENTARY SAMPLES Interim Report
L. J. Wei (National Cancer Inst.) Dec. 1980 15 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A095869; AFOSR-81-0125TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

A class of simple and robust estimators of the difference between location parameters of correlated variables is proposed when some observations on either of the variables are missing. We show that these estimators are consistent, asymptotically normally distributed, and insensitive to outlying observations. Asymptotic relative efficiency comparisons with other known estimators are made to show the advantage of the proposed estimators. GRA

N81-21853# Ohio State Univ., Columbus. Dept. of Statistics.
OPTIMAL SELECTION FROM A FINITE SEQUENCE WITH SAMPLING COST
Ishwari D. Dhariyal and Edward J. Dudewicz Jan. 1981 24 p refs
(Contract N00014-78-C-0543)
(AD-A096255; TR-146A) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two variations of the problem of choosing the largest of N independent and identically distributed random variables with sampling cost are studied. In the first case, it is assumed that the underlying distribution is continuous and known, but the information obtained by sampling is whether the sampled variable is larger or smaller than some given level. In the second case, it is assumed that the distribution of the random variables is continuous but unknown, and the information obtained is the rank of the sampled variable relative to the other variables already in the sample. In each case both the optimal strategy and the distribution of the stopping variable are discussed. GRA

N81-21854# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
ROBUST ESTIMATION IN HETEROSCEDASTIC LINEAR MODELS Interim Report
Raymond J. Carroll and David Ruppert Feb. 1981 34 p refs
(Grants AF-AFOSR-0080-80; NSF MCS-78-01240; AF Proj. 2304)
(AD-A096413; AFOSR-81-0219TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider a heteroscedastic linear model in which the variances are a parametric function of the mean responses and a parameter theta. We propose robust estimates for the regression parameter beta and show that, as long as a reasonable starting estimate of theta is available, our estimates of beta are asymptotically equivalent to the natural estimate obtained with known variances. A particular method for estimating theta is proposed and shown by Monte Carlo to work quite well, especially in power and exponential models for the variances. We also briefly discuss a 'feedback' estimate of beta. GRA

N81-21855# North Carolina Univ. at Chapel Hill.
TWO EXAMPLES OF TRANSFORMATIONS WHEN THERE ARE POSSIBLE OUTLIERS
Raymond J. Carroll Jan. 1981 19 p refs
(AF Proj. 2304)
(AD-A096398; AFOSR-81-0123TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The Box and Cox (1964) power transformation family and robust alternatives developed by Bickel and Doksum (1981) and Carroll (1980) are applied to data sets given by John (1978). The robust methods perform quite well compared to normal theory likelihood methods. GRA

N81-21856# Indiana Univ. at Bloomington. Dept. of Mathematics.
SCIENTIFIC REPORT Final Report
Madan L. Puri Feb. 1981 24 p refs
(Grant AF-AFOSR-2927-76)
(AD-A096414; AFOSR-81-0218TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This final report deals with the research accomplished in the following areas: Analysis of circular data, order statistics, nonparametric procedures in testing as well as estimation, tests of normality, limit theorems, polynomial splines, generalized inverse of matrices and their applications in statistics. Wiener processes, game theory, Fuzzy integrals, decision theory and the problems of the speed of convergence. GRA

N81-21857# Rochester Univ., N. Y. Dept. of Statistics.
EXPLORATORY MULTIVARIATE ANALYSIS. A GRAPHICAL APPROACH
K. Ruben Gabriel Jan. 1981 136 p refs Submitted for publication
(Contract N00014-80-C-0387)
(AD-A096400; TR-81/1) Avail: NTIS HC A07/MF A01 CSCL 12/1

This is an introduction and commentary on multivariate statistical methods which leans heavily on the biplot. The latter is used as a didactical device to clarify the structure of multivariate methods of exploratory data analysis. Topics dealt with are explorations of single batches in terms of variances and correlations and distances between subjects. GRA

N81-21858# Rochester Univ., N. Y. Dept. of Statistics.
COMPLETE INDEPENDENCE IN THE MULTIVARIATE NORMAL DISTRIBUTION Interim Report
Govind S. Mudholkar and Perla Subbaiah 1980 17 p refs
Prepared in cooperation with Oakland Univ.
(Grant AF-AFOSR-3360-77; AF Proj. 2304)
(AD-A095871; AFOSR-81-0181TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Testing complete independence is one of the simplest problems concerning the covariance structure of a set of measurements. A stepwise procedure proposed by S. N. Roy and R. E. Bargmann (1958) and a trace criterion due to H. Nagao (1973) are two well known competitors of the likelihood ratio test of the hypothesis derived assuming the multivariate normality. We consider some modifications of the Roy-Bargmann procedure based. on combinations of independent tests and find them to be asymptotically equivalent to the likelihood ratio test, which is optimal in terms of the exact slopes. The operating characteristics of various tests with samples of moderate size are examined empirically. GRA

N81-21859# Rochester Univ., N. Y. Dept. of Statistics.
A NORMAL APPROXIMATION FOR THE MULTIVARIATE LIKELIHOOD RATIO STATISTICS Interim Report
Govind S. Mudholkar and Madhusudan C. Trivedi (Pennwalt Corp. Rochester, N.Y.) 1980 15 p refs
(Grant AF-AFOSR-3360-77; AF Proj. 2304)
(AD-A095874; AFOSR-81-0180TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

For many multivariate hypotheses, under the normality assumptions, the likelihood ratio tests are optimal in the sense of having maximal exact slopes. The exact distributions needed for implementing these tests are complex and their tabulation is limited in scope and accessibility. In this paper, a method of constructing normal approximations to these distributions is described, and illustrated using the problems of testing sphericity and independence between two sets of variates. The normal

approximations are compared with well known competing approximations and are seen to fare well. GRA

N81-21860# Temple Univ., Philadelphia, Pa. Dept. of Statistics.
A GENERAL APPROACH TO LIMITING NORMALITY OF THE PRODUCT-LIMIT ESTIMATOR Interim Report
A. J. Quinzi and T. M. Smith Feb. 1981 16 p refs
(Grant AF-AFOSR-3673-78; AF Proj. 2304)
(AD-A096412; AFOSR-81-0216TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Langberg, Proschan and Quinzi obtain strongly consistent estimators for the unobservable marginal distributions of interest in the competing risks problem. These estimators resemble those of Kaplan and Meier but are appropriate when: (a) the risks are dependent and (b) death may result from simultaneous causes. We establish asymptotic normality of these estimators. Our result thereby extends that of Breslow and Crowley from the case of a continuous survival function to an arbitrary survival distribution. This preliminary report represents work currently in progress. GRA

N81-21861# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
A METHOD FOR ESTIMATING THE UPPER LIMIT OF THE VARIABILITY PARAMETER IN TWO-AND-THREE-LEVEL SYMMETRICAL BRUCETON TESTS Final Report, 1975 - 1977
R. J. Bauer and J. N. Ayres 20 Oct. 1980 35 p refs
(AFOSR MIPR 2311-B-033)
(AD-A095827; NSWC/WOL/TR-77-134) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report provides a method for estimating the upper limit of the variability parameter of Two and Three Level symmetrical Bruceton (stair-step) sensitivity tests, at a selected confidence level. Previously, it was impossible to make such an estimate. The method for estimating the variability parameter, as described in this report, should be of interest to all persons making probability predictions of safety and/or reliability based on the results of a Bruceton test. GRA

N81-21862# Loughborough Univ. of Technology (England). Dept. of Mathematics.
BAYESIAN RANK ANALYSES OF THE CHANGE-POINT MODEL: LOCATION AND TREND CHANGES
A. N. Pettitt Jul. 1979 21 p refs
(Math-Res-151) Avail: NTIS HC A02/MF A01

Change-point models, one involving a change in location and another a simple trend after the change, are analyzed using the ranks of the observations. A posterior distribution for the change-point is derived so that inferences about it can be made in small samples. Examples are given comparing the posterior distribution of the change-point based on the ranks with normal theory posterior distributions. Author (ESA)

N81-21863# Loughborough Univ. of Technology (England). Dept. of Mathematics.
AN APPROXIMATION TO THE PARTIAL LIKELIHOOD FOR COX'S REGRESSION MODEL OF THE ANALYSIS OF SURVIVAL DATA
I. G. Vlachonikolis Aug. 1980 14 p refs
(Maths-Res-151) Avail: NTIS HC A02/MF A01

An approximation applicable to the case of tied observations with large multiplicities of failures is considered in association with the general regression model for the hazard function. The approximation is shown to be good when the number of actual failures at the longest time is small relative to the number at risk. Results show that can safely be used for tests of significance and estimation of the hazard function. Results are compared for two small sets of data, the second extracted from larger set of socio-legal data. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-21864*# Old Dominion Univ., Norfolk, Va. Dept. of Electrical Engineering.
DESIGN OF MULTIVARIABLE FEEDBACK CONTROL SYSTEMS VIA SPECTRAL ASSIGNMENT Progress Report, 1 Aug. 1980 - 28 Feb. 1981
Stanley R. Liberty, Roland R. Mielke, and Leonard J. Tung Apr. 1981 20 p refs
(Grant NsG-1650)
(NASA-CR-164189) Avail: NTIS HC A02/MF A01 CSCL 12B

Applied research in the area of spectral assignment in multivariable systems is reported. A frequency domain technique for determining the set of all stabilizing controllers for a single feedback loop multivariable system is described. It is shown that decoupling and tracking are achievable using this procedure. The technique is illustrated with a simple example. Author

N81-21865# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
SCHEDULING SUBJECT TO RESOURCE CONSTRAINTS: CLASSIFICATION AND COMPLEXITY
J. Blazewicz (Politech. Poznanska, Poland), J. K. Lenstra, and A. H. G. RinnooyKan (Erasmus Univ.) Aug. 1980 19 p refs Submitted for publication
(Grants NATO-9.2.02(SRG.7); NSF MCS-78-20054)
(MC-BW-127/80) Avail: NTIS HC A02/MF A01

An extension of deterministic sequencing and scheduling problems where jobs are processed on machines of limited capacity is proposed in which the jobs require the use of additional scarce resources during their execution. Various assumptions are made about the number of resources, the amounts in which they are available, and the amount which are required for the operations. A classification scheme for resource constrained scheduling problems is presented, and a range of initial results on their computational complexity is outlined. Models involving parallel machines, unit time jobs and the maximum completion time criterion are discussed in detail. Applications to other models, i.e., extensions to other optimality criteria, preemptive scheduling, and multi-operation models, are also briefly discussed. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-21866# Indiana Univ. at Bloomington. Dept. of Mathematics.
ON THE E-OPTIMALITY OF CERTAIN PBIB DESIGNS
Gregory M. Constantine Jan. 1980 21 p refs
(Contract AF-AFOSR-0170-80; AF Proj. 2304)
(AD-A095875; AFOSR-81-0129TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that several families of PBIB designs are E-optimal over the collection of all block designs. Among these, the partial geometries with two associate classes are shown. The duals of these designs are also E-optimal. When uniform on rows, these designs remain E-optimal in the additive setting of two way elimination of heterogeneity. GRA

N81-21867# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
THE THEORY OF COMPUTATIONAL COMPLEXITY APPLIED TO PROBLEMS IN MATCHING, COVERING, AND PARTITIONING [THEORIE DE LA COMPLEXITE DE CALCUL APPLIQUEE AUX PROBLEMES DE COUPLAGE, RECOUVEMENT ET PARTITIONING]
J. K. Lenstra and A. H. G. RinnooyKan (Erasmus Univ., Rotterdam) Aug. 1980 22 p refs In FRENCH Presented at Colloq. Regards sur la Theorie des Graphs, Cerisy-la-Salle, France, 12-19 Jun. 1979 Submitted for publication
(Grant NATO-9.2.02(SRG.7))
(MC-BW-125/80) Avail: NTIS HC A02/MF A01

The theory of computational complexity of discrete optimization problems in combinatorial analysis is briefly described. All problems considered can be formulated as problems in linear programming. The concept NP complete is defined, then a category

of problems for which an algorithm exists whose calculation time, in the worst case, increases polynomially rather than exponentially is identified. Results show that certain matching, covering, and partitioning problems are particularly well suited to the demonstration of NP completeness. Author (ESA)

N81-21868# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
AN INTRODUCTION TO POLYMATROIDAL NETWORK FLOWS
E. L. Lawler (California Univ., Berkeley) Aug. 1980 19 p refs Presented at Conf. on Anal. and Design of Algorithms in Combinatorial Optimization, Udine, Italy, 10-21 Sep. 1979 Submitted for publication
(Grant NSF MCS-78-20054)
(MC-BW-129/80) Avail: NTIS HC A02/MF A01

The theory of polymatroidal network flows is developed. It is demonstrated that this theory provides a satisfactory generalization and unification of both classical network flow theory and much of the theory of matroid optimization. In the classical network flow model, flows are constrained by the capacities of individual arcs. In the polymatroidal network flow model, flows are constrained by the capacities of sets of arcs. Yet the essential features of the classical model are retained, the augmenting path theorem, the integral flow theorem, and the max flow min cut theorem are all shown to yield to straightforward generalization. Polymatroid intersection and matroid partitioning are covered. How the polymatroidal network flow model can be used to formulate and solve problems with no readily apparent polymatroidal structure is also indicated. Author (ESA)

N81-21869# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
CONTROLLED INVARIANT DISTRIBUTIONS FOR AFFINE SYSTEMS ON MANIFOLDS
H. Nijmeijer Aug. 1980 24 p refs Presented at Math. Systems Theory Meeting, Coventry, England, 7-11 Jul. 1980 Submitted for publication
(MC-BW-130/80) Avail: NTIS HC A02/MF A01

The problem of nonlinear (A,B) invariance is discussed with respect to the concept of a k-dimensional distribution function and using differential geometry. The geometric approach for linear systems is cited as a successful way to solve various synthesis problems in control theory. An analogous theory for nonlinear systems is developed. The systems considered have the form, locally, scalar product of X(t) equals A(x(t)) + the summation M, i = 1, U sub i (t) B sub i (x(t)). For nonlinear control systems, under conditions which are equivalent to those in the linear case, the problem of controlled invariance is completely solved. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-21870# Los Alamos Scientific Lab., N. Mex.
DYNAMIC THEORY: SOME SHOCK WAVE AND ENERGY IMPLICATIONS
Pharis E. Williams Feb. 1981 11 p refs
(Contract W-7405-eng-36)
(LA-8402-MS) Avail: NTIS HC A02/MF A01

The Dynamic Theory, a unifying five dimensional theory of space, time, and matter, is examined. The theory predicts an observed discrepancy between shock wave viscosity measurements at low and high pressures in aluminum, a limiting mass-to-energy conversion rate consistent with the available data, and reduced pressures in electromagnetically contained controlled-fusion plasmas. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-21871*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
HANDBOOK OF AIRCRAFT NOISE METRICS Final Report
Ricarda L. Bennett and Karl S. Pearsons Washington NASA Mar. 1981 221 p refs
(Contract NAS1-14611)
(NASA-CR-3406; Rept-4215) Avail: NTIS HC A10/MF A01 CSCL 20A

Information is presented on 22 noise metrics that are associated with the measurement and prediction of the effects of aircraft noise. Some of the instantaneous frequency weighted sound level measures, such as A-weighted sound level, are used to provide multiple assessment of the aircraft noise level. Other multiple event metrics, such as day-night average sound level, were designed to relate sound levels measured over a period of time to subjective responses in an effort to determine compatible land uses and aid in community planning. The various measures are divided into: (1) instantaneous sound level metrics; (2) duration corrected single event metrics; (3) multiple event metrics; and (4) speech communication metrics. The scope of each measure is examined in terms of its: definition, purpose, background, relationship to other measures, calculation method, example, equipment, references, and standards. A.R.H.

N81-21872*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
TRANSMITTED SOUND FIELD DUE TO AN IMPULSIVE LINE ACOUSTIC SOURCE BOUNDED BY A PLATE FOLLOWED BY A VORTEX SHEET
Toshiki Miura and C. C. Chao Jan. 1980 85 p refs
(Grant NsG-2007)
(NASA-CR-164180; SU-JIAA-TR-27) Avail: NTIS HC A05/MF A01 CSCL 20A

The propagation of sound due to a line acoustic source in the moving stream across a semiinfinite vortex sheet which trails from a rigid plate is examined in a linear theory for the subsonic case. A solution for the transmitted sound field is obtained with the aid of multiple integral transforms and the Wiener-Hopf technique for both the steady state (time harmonic) and initial value (impulsive source) situations. The contour of inverse transform and hence the decomposition of the functions are determined through causality and radiation conditions. The solution obtained satisfies causality and the full Kutta conditions. The transmitted sound field is composed of two waves in both the stady state and initial value problems. One is the wave scattered from the edge of the plate which is associated with the bow wave and the instability wave. These waves exist in the downstream sectors. The other is the wave transmitted through the vortex sheet which is also associated with the instability wave. Regional divisions of the transmitted sound field are identified. M.G.

N81-21873*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUBJECTIVE FIELD STUDY OF RESPONSE TO IMPULSIVE HELICOPTER NOISE
Clemans A. Powell Apr. 1981 43 p refs
(NASA-TP-1833; L-14205) Avail: NTIS HC A03/MF A01 CSCL 20A

Subjects, located outdoors and indoors, judged the noisiness and other subjective noise characteristics of flyovers of two helicopters and a propeller driven airplane as part of a study of the effects of impulsiveness on the subjective response to helicopter noise. In the first experiment, the impulsive characteristics of one helicopter was controlled by varying the main rotor speed while maintaining a constant airspeed in level flight. The second experiment which utilized only the helicopters, included descent and level flight operations. The more impulsive helicopter was consistently judged less noisy than the less impulsive helicopter at equal effective perceived noise levels (EPNL). The ability of EPNL to predict noisiness was not improved by the

addition of either of two proposed impulse corrections. A subjective measure of impulsiveness, however, which was not significantly related to the proposed impulse corrections, was found to improve the predictive ability of EPNL. A.R.H.

N81-21874*# Lafayette Coll., Easton, Pa. Dept. of Electrical Engineering.
ULTRASONIC RANGING FOR THE OCULOMETER Progress Report, 1 Mar. 1980 - 28 Feb. 1981
W. J. Guy 28 Feb. 1981 91 p refs
(Contract NAG1-45)
(NASA-CR-164172) Avail: NTIS HC A05/MF A01 CSCL 20A

Ultrasonic tracking techniques are investigated for an oculometer. Two methods are reported in detail. The first is based on measurements of time from the start of a transmit burst to a received echo. Knowing the sound velocity, distance can be calculated. In the second method, a continuous signal is transmitted. Target movement causes phase shifting of the echo. By accumulating these phase shifts, tracking from a set point can be achieved. Both systems have problems with contoured targets, but work well on flat plates and the back of a human head. Also briefly reported is an evaluation of an ultrasonic ranging system. Interface circuits make this system compatible with the echo time design. While the system is consistently accurate, it has a beam too narrow for oculometer use. Finally, comments are provided on a tracking system using the Doppler frequency shift to give range data. M.G.

N81-21875# Argonne National Lab., Ill. Components Technology Div.
MONITORING TEMPERATURES IN COAL CONVERSION AND COMBUSTION PROCESSES VIA ULTRASOUND
N. Gopalsami (Illinois Univ. at Chicago Circle), A. C. Raptis, and T. P. Mulcahey Feb. 1980 48 p refs
(Contract W-31-109-eng-38)
(ANL-FE-49622-TM09; TM-9) Avail: NTIS HC A03/MF A01

The state of the art of instrumentation for monitoring temperatures in coal conversion and combustion systems is examined. The instrumentation types studied include thermocouples, radiation pyrometers, and acoustical thermometers. The capabilities and limitations of each type are reviewed. A feasibility study of the ultrasonic thermometry is described. A mathematical model of a pulse-echo ultrasonic temperature measurement system is developed using linear system theory. The mathematical model lends itself to the adaptation of generalized correlation techniques for the estimation of propagation delays. Computer simulations are made to test the efficacy of the signal processing techniques for noise-free as well as noisy signals. Based on the theoretical study, acoustic techniques to measure temperature in reactors and combustors are feasible. DOE

N81-21876# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
NOISE AMPLIFICATION AND NOISE REDUCTION BY INFLUENCING THE FREE JETS FROM CIRCULAR AND NONCIRCULAR APERTURES, TAKING INTO CONSIDERATION RING VORTEX INSTABILITY [GERAEUSCHVERSTAERKUNG UND GERAEUSCHMINDERUNG BEI BEEINFLUSSTEN FREISTRAHLEN AUS KREISFOERMIGEN UND NICHTKREISFOERMIGEN OEFFNUNGEN UNTER BERUECKSICHTIGUNG DER RINGWIRBELINSTABILITAET]
Peter E. M. Schneider Dec. 1979 41 p refs In GERMAN (MPIS-3/1979; ISSN-0436-1199) Avail: NTIS HC A03/MF A01

The instability of single ring vortex motion is discussed, and the jointly reciprocal action of vortex rings with similar and unsimilar translational axes is described. For free jets, either from circular or noncircular nozzles, the possibility of scaling the occurrence and dispersion of the large number of vortices and vortex wakes, differentially, spatially and temporally, is considered. The frequency spectrum of a turbulent free jet is shown to depend on a discrete, variable periodic generation of vortices. This generations is related to the natural frequency of the free jet. By influencing the free jet natural frequency, noise due to vortex interactions can thus be actively increased or diminished. Author (ESA)

N81-21877# Southampton Univ. (England). Inst. of Sound and Vibration Research.
MEASUREMENT AND PREDICTION OF CONSTRUCTION PLANT NOISE
H. S. Gill Sep. 1980 226 p refs
(ISVR-TR-112) Avail: NTIS HC A11/MF A01

Propagation characteristics of noise from stationary and mobile sources over realistic ground surfaces were studied. A total of 14 sets of propagation measurements from various types of construction equipment were made. Propagation data indicate that equivalent sound levels from stationary or quasistationary construction equipment propagate with an attenuation rate of approximately 6.76 and 6.13 dB (A) per doubling of distance up to 150 m from the source over disturbed and compacted Earth surfaces, respectively. Other significant results are reported. Author (ESA)

N81-21878# Centro Informazioni Studi Esperienze, Milan (Italy).
AN ACOUSTICAL MONITORING SYSTEM FOR EARLY DIAGNOSIS OF TUBE-BUNDLE BREAKDOWN [UN SISTEMA STRUMENTALE ACUSTICO PER DIAGNOSI PRECOCI DI ROTTURE DI FASCI TUBIERI]
A. Azzoni, S. Bevilacqua (Ente Nazionale per l'Energia Elettrica), A. Clapis, and G. Maino (Ente Nazionale per l'Energia Elettrica) 1980 27 p In ITALIAN Presented at PnD '80 Conf. Strumentazio, Milan, 13-14 Jun. 1980
(CISE-1612) Avail: NTIS HC A03/MF A01

Some of the main components of an acoustical monitoring system are described. The components described are: a piezoelectric pressure transducer; an amplifier and bandpass filter for each monitoring point; a rms voltmeter; a registering device; and an alarm system. The monitoring system was based on the increase in noise level produced by the turbulent flow of fluid leaking through a crack. The technique was tested experimentally and was adopted for boilers and high pressure heat exchangers in thermoelectric plants. Author (ESA)

N81-21375# Mar, Inc., Rockville, Md.
UNDERWATER ACOUSTIC MODELING TECHNIQUES
P. C. Etter *In* Shock and Vibration Information Center The Shock and Vibration Digest, Vol. 13, No. 2 Feb. 1981 p 11-20 refs (For primary document see N81-21374 12-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20/11

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-21879# California Univ., San Diego, La Jolla. Dept. of Chemistry.
MOLECULAR DYNAMICS AND SPECTRA. 2: DIATOMIC RAMAN
Kent R. Wilson, Peter H. Berens, and Steven R. White Feb. 1981 38 p refs Submitted for publication
(Contract N00014-78-C-0325)
(AD-A096072; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

This paper indicates that infrared and Raman rotational and fundamental vibrational-rotational spectra of dense systems (high pressure gases, liquids and solids) are essentially classical, in that they can be computed and understood from a basically classical mechanical viewpoint, with some caveats for features in which anharmonicity is important, such as the detailed shape of Q branches. It is demonstrated here, using the diatomic case as an example, that ordinary, i.e. nonresonant, Raman band contours can be computed from classical mechanics plus simple quantum corrections. Classical versions of molecular dynamics, linear response theory and ensemble averaging, followed by straightforward quantum corrections, are used to compute the pure rotational and fundamental vibrational-rotational Raman band contours of N2 for the gas phase and fo4 solutions of N2 in different densities of gas phase Ar and in liquid Ar. The evolution is seen from multiple peaked line shapes characteristic of free

rotation in the gas phase to single peaks characteristic of hindered rotation in the liquid phase. Comparison is made with quantum and correspondence principle classical gas phase spectral calculations and with experimental measurements for pure N2 and N2 in liquid Ar. Three advantages are pointed out for a classical approach to infrared and Raman spectra. GRA

N81-21880# Wisconsin Univ. - Madison. Dept. of Chemistry.
COLLISIONAL ENERGY TRANSFER IN HIGHLY VIBRATIONALLY EXCITED MOLECULES Summary Progress Report, Jun. 1980 - May 1981
F. Flemming Crim 1 Mar. 1981 6 p refs
(Contract N00014-79-C-0415)
(AD-A096083) Avail: NTIS HC A02/MF A01 CSCL 07/4

Combining the techniques of direct excitation of overtone vibrations and time resolved spectroscopic detection permits detailed measurements of the vibrational and rotational relaxation of highly vibrationally excited molecules. Using this technique, we have measured vibrational and rotational relaxation in HF(v = 3,4,5,). By observing near-infrared fluorescence, we determine the self-relaxation probabilities for HF(v = 3,4,5) to be 0.19, 0.47, and 0.97, respectively, and find that the rates decrease more rapidly with temperature in these high levels than for v = 1. Using laser double resonance to probe individual rotational states, we find phenomenological rotational relaxation rate constants which decrease montonically with rotational energy change in the vibrationally excited molecule. GRA

N81-21881# Naval Research Lab., Washington, D. C. Condensed Matter and Radiation Science Div.
AN X-RAY DIAGNOSTIC FOR LIGHT-ION CURRENT MEASUREMENTS Interim Report
R. D. Bleach, D. J. Nagel, D. Mosher, and S. J. Stephanakis 4 Mar. 1981 29 p refs
(AD-A095923; NRL-MR-4462) Avail: NTIS HC A03/MF A01 CSCL 20/8

A technique to determine the number and current density of MeV protons in an intense beam was tested on the GAMBLE 2 generator. Diode current and voltage and an absolute measurement of K-line radiation emitted from a 6 micrometer thick aluminum target were used to determine the number and current density of protons incident on the target. Time-dependent X-ray measurements can be used to infer variations in the ion-beam current density. GRA

N81-21882# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
DEVELOPMENT AND APPLICATION OF LOW ENERGY X-RAY AND ELECTRON PHYSICS Interim Scientific Report, 1 Oct. 1979 - 30 Sep. 1980
Burton L. Henke Jan. 1981 144 p refs
(Grant AF-AFOSR-0027-79)
(AD-A096376; AFOSR-81-0147TR) Avail: NTIS HC A07/MF A01 CSCL 20/8

Contents: X-ray spectrometry in the 100-1000 eV region; the characterization of X-ray photocathodes in The 0.1-10 keV photon energy region; description of a fixed, elliptical analyzer spectrograph for pulsed source analysis; low energy X-ray interaction coefficients: photoionization, scattering and reflection; first-page abstracts of selected examples of some research publications; and the low energy X-ray and electron spectrographic systems developed under this program. GRA

N81-21883# Ben Gurion Univ. of the Negev, Beersheva (Israel). Dept. of Chemistry.
ELECTRONIC ENERGY TRANSFER FROM NITROGEN MOLECULES TO METAL ATOMS Final Report, 1 Sep. 1978 - 31 Aug. 1980
S. Rosenwaks and I. Nadler 30 Nov. 1980 21 p refs
(Grant AF-AFOSR-3718-78; AF Proj. 2301)
(AD-A096026; EOARD-TR-80-17) Avail: NTIS HC A02/MF A01 CSCL 20/5

The results of this research show that electronic excitation of metal atoms by N2(A) molecules is easily obtained in the metals studied. Moreover, EET is a fast and preferential process resulting in population inversion between some of the Cu states. Evidence is presented for the possible importance of the Franck-Condon principle in the collisional quenching of N2(A) by Cu. The similarity of the population distribution of the Cu states in the N2(A) - Cu and in the NF3 - Cu systems corroborates the suggestion that in the latter case the inverted population in copper originates from chemically produced N2(A). LIF studies of N2(B,v) have demonstrated a multiexponential decay which is interpreted as a fast collisional coupling of N2(B,v) to adjacent energy levels and a slower overall decay of these coupled levels. Our results may have bearing on existing interpretations of N2(B) chemistry. The 2N2(A) energy pooling rate constant could be estimated more accurately once the N2(B,v) quenching rate constant are found (13). This accuracy is needed since the energy pooling reaction is a competitive reaction to EET from N2(A). The information presented on the N2 Herman infrared system due to energy pooling may help in the identification of the upper and lower states of this unassigned band. GRA

N81-21884# North Carolina Univ. at Chapel Hill. Dept. of Physics and Astronomy.
RADIATION EFFECTS ON SOLIDS Progress Report
J. H. Crawford, Jr. 1980 10 p refs
(Contract DE-AS05-78ER-05866)
(ORO-5866-11) Avail: NTIS HC A02/MF A01

Research topics reported are: radiation effects and defects in spinel (MgAl2O4), F and F(+) centers in Al2O3, and irradiation experiments on MgO:Li crystals. DOE

N81-21885# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
STUDY OF DEFECTS, RADIATION DAMAGE AND IMPLANTED GASES IN SOLIDS BY FIELD-ION AND ATOM PROBE MICROSCOPY
David N. Seidman, Jun Amano, and Alfred Wagner Oct. 1980 21 p refs
(Contract DE-AS02-76ER-03158)
(DOE/ER-03518-94; MSC4323) Avail: NTIS HC A02/MF A01

The ability of the field-ion microscope to image individual atoms was applied to the study of fundamental properties of point defects in irradiated or quenched metals. The capability of the atom probe field-ion microscope to determine the chemistry - that is, the mass-to-charge ratio - of a single ion was used to investigate the behavior of different implanted species in metals. A brief review is presented of: (1) the basic physical principles of the field-ion and atom-probe microscope; (2) the many applications of these instruments to the study of defects and radiation damage in solids; and (3) the application of the atom-probe field-ion microscope to the study of the behavior of implanted (3)He and (4)He atoms in tungsten. DOE

N81-21886# California Univ., Berkeley. Lawrence Berkeley Lab. Chemical Biodynamics Div.
CIRCULAR INTENSITY DIFFERENTIAL SCATTERING OF CHIRAL MOLECULES Ph.D. Thesis
Carlos J. Bustamante Dec. 1980 292 p refs
(Contract W-7405-eng-48)
(LBL-12110) Avail: NTIS HC A13/MF A01

A theory of the circular intensity differential scattering (CIDS) of chiral molecules as modelled by a helix oriented with respect to the direction of incidence of light is presented. It is shown that a necessary condition for the existence of CIDS is the presence of an asymmetric polarizability in the scatterer. The polarizability of the scatterer is assumed generally complex, so that both refractive and absorptive phenomena are taken into account. DOE

N81-21887# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
FEATURES OF POSSIBLE POLARIZED PHOTON BEAMS AT HIGH ENERGY AND CORRESPONDING PHYSICS PROGRAMME OR THE PROTON STRUCTURE FUNCTION USING REAL PHOTONS
Michael J. Tannenbaum 1980 10 p refs Presented at the 1980 Symp. on High Energy Phys. with Polarized Beams and Polarized Targets, Lausanne, Switzerland, 25 Sep. - 1 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28586; CONF-800994-9) Avail: NTIS HC A02/MF A01

In the range of electron energies available at Fermilab, 100 GV less than or equal to E less than or equal to 500 GV, coherent Bremsstrahlung in crystals, particularly diamond, gives a huge enhancement to the equivalent photon spectrum at large values of x where x = k/E. The photons in this enhancement are polarized. Requirements on electron beam energy spread, angular divergence and spot size imposed by the use of a diamond as a radiator are discussed. The physics program emphasizes hard processes and tests of QCD using polarization. DOE

N81-21888# Oak Ridge National Lab., Tenn. Office of Language Services.
CRYOGENIC ELECTRON BEAM IONIZER KRION-2
V. P. Ovsyannikov and E. D. Donets 1980 12 p refs Transl. into ENGLISH from Joint Inst. for Nucl. Res. (USSR), Dubna 1980
(ORNL-TR-4703) Avail: NTIS HC A02/MF A01

An electron beam ionization method was developed for the production of beams of multicharged ions. The method is based on the cryogenic electron beam ionizer KRION, with which beams of nuclei of carbon and nitrogen, and later oxygen and neon are obtained, completely electron free. The KRION 2 was created for further development of the electron beam method of ionization as well as for studying ionization processes of positive ions by electron impact. DOE

N81-21889# Los Alamos Scientific Lab., N. Mex.
CHARGE EXCHANGE CROSS SECTIONS FOR Li(-) IONS AT 6 MeV
J. P. Aldridge 1981 20 p refs Sponsored by DOE
(LA-8682-MS) Avail: NTIS HC A02/MF A01

Charge fractions for charge exchange of 6 MeV (7)Li(-) ions in H2, N2, O2, and He have been measured. Cross sections for Li(-) and Li(0) destruction are derived from the target thickness dependence of the charge fractions. M.G.

N81-21890# Loughborough Univ. of Technology (England). Dept. of Mathematics.
DIRECT NUMERICAL SOLUTION OF THE INTEGRAL EQUATION FOR NEUTRON SLOWING DOWN
G. A. Evans, J. Hyslop, and A. P. G. Morgan Nov. 1979 15 p refs
(Maths-Res-145) Avail: NTIS HC A02/MF A01

A recursive numerical integration scheme based on a method which is applicable to an infinite nonabsorbing medium is presented. The solution possesses a finite discontinuity providing a very stringent test of the recursive quadrature scheme. The accuracy and efficiency of the method are tested and comparisons are made with the results obtained from an alternative form of the basic equations. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-21891# Department of Energy, Washington, D. C. Office of Waste Isolation.
STATUS OF TECHNOLOGY FOR ISOLATING HIGH-LEVEL RADIOACTIVE WASTES IN GEOLOGIC REPOSITORIES Status Report
Cyrus Klingsberg and James Duguid (Battelle Memorial Inst., Columbus, Ohio) Oct. 1980 135 p refs
(DOE/TIC-11207(Draft)) Avail: NTIS HC A07/MF A01

An attempt to summarize the status of scientific and technological knowledge relevant to long term isolation of high level and transuranic wastes in a mined geologic repository is presented. Needed information and topics in which work is under way or needed to reduce uncertainties are identified. The major findings and conclusions on the following topics are presented: importance of the systems approach; prospects for successful isolation of wastes; need for site specific investigations; human activities in the future; importance of modelling; disposal of transuranic wastes; and the status of technology of isolation barriers, performance assessment, site selection and characterization, and potential host rocks. DOE

N81-21892# Florida Univ., Gainesville. Dept. of Chemistry.
HIGH ENERGY SOURCES AND MATERIALS: HIGH-TEMPERATURE MOLECULES AND MOLECULAR ENERGY STORAGE Final Report, 1 Nov. 1975 - 31 Oct. 1980
William Weltner, Jr. Oct. 1980 10 p refs
(Grant AF-AFOSR-2906-76; AF Proj. 2303)
(AD-A096039; AFOSR-81-0179TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

The objective of this research was the characterization of molecular species which are important because of (a) their occurrence in high-temperature environments, as for example in the vapor over refractory solids, and in combustion, flames, and propellant burning; (b) their relevance to clarification and/or extension of the basic theory of molecular properties. The molecules studied were usually highly reactive or metastable and often inaccessible by the usual gas-phase spectroscopic methods. They were therefore trapped in a solid matrix, usually neon or orgon, at 4 K and investigated by optical and electron-spin-resonance (ESR) spectroscopies. This isolation procedure is known to produce only small perturbations and to yield information pertinent to the gas-phase species. The species studied included boron and bromine atoms, methylene radicals, diatomic boron, beryllium hydroxide, diatomic chlorine anion, carbonyl silene, diazasilene, the first-row transition-metal mono, di, and trifluorides and their corresponding hydrides and oxides, and a few rare-earth hydrides and fluorides. Vibrational frequencies, electronic transitions, g factors, spin-rotation constants, hyperfine coupling constants, zero-field-splittings, ground-state multiplicities, and perhaps some information about structure, were obtained. The molecules contained from one to seven unpaired electrons. GRA

N81-21893# JAYCOR, Alexandria, Va.
A REPORT ON COLLECTIVE ION ACCELERATION VIA SPACE CHARGE WAVES ON INTENSE RELATIVISTIC ELECTRON BEAMS Final Report, 20 Dec. 1979 - 19 Dec. 1980
Frederick Mako and Robert Lucey 13 Feb. 1981 57 p refs
(Contract N00173-80-C-0039)
(AD-A096154; JAYCOR-PSD-200-81-002-FR) Avail: NTIS HC A04/MF A01 CSCL 20/7

Collective methods of ion acceleration using intense relativistic electron beams (IREB) have stimulated a great deal of interest in the past few years. The main virtue of an IREB collective ion accelerator is the high internal electric field strength. The primary drawback has been an insufficient ion energy gain or inadequate scaleability. An extensive study for generating a high quality electron beam has been done and is presented in Section 2. In Section 3 an intense ion injector study was conducted by the method of computer simulation. The last addition to the proposal was a design for producing a toroidal magnetic field. This field will be needed in a future study of high energy and high current electron beams. GRA

N81-21894# Naval Research Lab., Washington, D. C. Radiation-Matter Interaction Branch.
TRANSPORT THEORY FOR HEAVY ION BEAMS NEAR A TARGET SURFACE Interim Report
G. P. Mueller 18 Mar. 1981 30 p refs
(RR0210302)
(AD-A096111; NRL-MR-4469) Avail: NTIS HC A03/MF A01 CSCL 20/8

The method of Manning and Padgett (MP) for studying the transport of heavy ion beams in amorphous solids is modified to allow for inelastic (electronic) slowing of the ion beam as well as the losses from elastic scattering. The MP method consists of writing the distribution function that satisfies the Boltzmann transport equation in a form that reflects the physical processes that the beam ions undergo as they enter the target. In our version of this method, the beam distribution function consists of several terms with the following characteristics: n terms that represent beam ions that have undergone exactly zero, one, two, ..., n-1 elastic collisions, and a final term that represents beam ions that have undergone n or more elastic collisions. In the present work the formal solutions of the Boltzmann equation

are given for these various terms. The explicit forms of the first two terms are presented and the results of sample calculations are reported. GRA

N81-21895# Hanford Engineering Development Lab., Richland, Wash.
LARGE-SCALE FISSION PRODUCT CONTAINMENT TESTS
R. K. Hilliard and A. K. Postma Nov. 1980 34 p refs Presented at the ANS Winter Meeting, Washington, D.C., 16-21 Nov. 1980
(Contracts DE-AC14-76FF-02170; EY-76-C-14-2170)
(HEDL-SA-2254-FP; CONF-801107-51) Avail: NTIS HC A03/MF A01

The Containment Systems Experiment (CSE) program is reviewed, with emphasis on the inherent processes that remove fission products from containment atmospheres and reduce their leakage to the environment. The CSE containment vessel was sized to represent a 1/5 linear scale model of a typical 1000 MW(e) PWR. Nineteen tests were performed in a stream-air atmosphere simulating post-LOCA conditions. In eight tests containment sprays were operated, in five tests a recirculating filter-adsorber loop was operated, and in six tests only natural, passive processes occurred. Sprays were the most effective in removing airborne iodine and particulate aerosols, followed by the filter loop. Although not as effective as the engineered safety features, natural processes of diffusion to surfaces, reaction with paint, gravity settling, and removal in leak paths are shown to be significant. DOE

N81-21896# Rochester Univ., N. Y.
EXPERIMENTAL STUDIES OF ELEMENTARY PARTICLE INTERACTIONS AT HIGH ENERGIES Technical Progress Report
Jan. 1981 20 p refs
(Contract DE-AC02-76ER-02232)
(DOE/ER-02232/T1) Avail: NTIS HC A02/MF A01

During 1980, the research program in experimental high energy physics at The Rockefeller University made substantial contributions to the understanding of both strong and weak interactions. The principal laboratories utilized are the 500 GeV accelerator at Fermilab and the Intersecting Storage Rings facility at CERN. The latter is a unique facility which provides the highest available energies for proton-proton collisions. The results of the individual experimental projects obtained during 1980 are described in detail. DOE

N81-21897# Cincinnati Univ., Ohio.
INELASTIC STRONG INTERACTIONS AT HIGH ENERGIES Annual Progress Report, 1 Jun. 1980 - 1 May 1981
Peter Suranyi Jan. 1981 8 p refs
(Contract DE-AS02-76ER-02978)
(DOE/ER-02978/6) Avail: NTIS HC A02/MF A01

Grand Unified Field Theories were studied, concentrating on the symmetry breaking by Higgs bosons with the inclusion of single-gauge-loop corrections at both zero and nonzero temperature. The possible metastable phases of an SU(N) gauge theory broken by a Higgs boson of the adjoint representation are SU(r)xSU(N-r)xU(1) only. The phase diagram of broken SU(N) and O(2N) theories was displayed as a function of two renormalization-group-invariant parameters. All phase transitions were found to be first order and, at least in the Coleman-Weinberg regime, the phase diagram is completely different from that of the tree approximation. Upper bounds were obtained for the phase-transition temperature in terms of the Higgs boson mass both for an SU(N) field theory with a Higgs boson in the adjoint representation and for the Glashow-Weinberg-Salam theory of electro-weak interactions. Finally, upper bounds were found for the masses of Higgs bosons in both of the above-mentioned types of theories in terms of the supercooling ratio, provided the expansion rate of the universe is too large and the tunneling rate is too small to complete the phase transition before the symmtric phase becomes unstable. DOE

N81-21898# Tufts Univ., Medford, Mass. Dept. of Physics.
POLARIZATION AS AN INSTRUMENT TO EXPLORE THE PHENOMENOLOGY AND DYNAMICS OF VECTOR SPACES
G. R. Goldstein and M. J. Moravesik (Oregon Univ., Eugene) 1980 15 p refs
(Contracts EY-76-S-06-2230; DE-AT06-76ER-70004)
(DOE/ER-70004/284) Avail: NTIS HC A02/MF A01

It is shown on the example of an extensive set of polarization data of p-p elastic scattering at 6 GeV/c and t = 0.6 GeV(2)/c(2) that the careful choice of polarization formalisms to simplify the relationship between observables and amplitudes that nevertheless maintains a maximal amount of flexibility can enormously simplify the determination of the amplitudes as well as can yield clues to the dynamics underlying a reaction in atomic, nuclear, or high energy physics. DOE

N81-21899# California Univ., Livermore. Lawrence Livermore Lab.
CONTINUOUS-FLOW LEACH TESTING METHOD FOR VARIOUS NUCLEAR WASTE FORMS
David G. Coles 4 Dec. 1980 31 p refs Presented at the ORNL Conf. on the Leachability of Radioactive Solids, Gatlinburg, Tenn., 9-12 Dec. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-85006; CONF-801206-7) Avail: NTIS HC A03/MF A01

Repository relevant leaching test places the waste form of interest into a flowing stream of leachant. The flow rates can be set to approximate the low flow rates encountered in actual aquifers. The leachant contacts the waste only once and then exits the cell where it is collected and analyzed. Such a scheme avoids potential solution saturation problems encountered with static tests. The composition of leachants used with the test has ranged from saturated salt brine to distilled water. Temperature has been varied from 25 C to 75 C. These values cover the range of ambient temperatures expected at depths of 2 to 3 km. This test was designed to reproduce conditions of a flooded repository in the laboratory. The testing methodology is discussed as well as examples of data obtained from leaching a variety of waste forms under various conditions. DOE

N81-21900# Battelle Pacific Northwest Labs., Richland, Wash.
GEOCHEMICAL MODELING OF THE NUCLEAR WASTE REPOSITORY SYSTEM, A STATUS REPORT
W. J. Deutsch Dec. 1980 31 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3518) Avail: NTIS HC A03/MF A01

A reaction path simulation code, which estimates the products of specific rock/water reactions, was tested using basalt and ground water. Results show that the mass transfer capabilities of the code are useful in chemical evolution studies and scenario analyses. The status of geochemical modeling as it currently applies to the chemical system of a hypothetical nuclear waste repository in basalt is explained and the plan for further development and application is presented. DOE

N81-21901# Louisiana State Univ. and A&M Coll., Baton Rouge. Dept. of Physics and Astronomy.
STRUCTURE OF NUCLEI FAR FROM BETA STABILITY Progress Report, 15 May 1980 - 14 May 1981
E. F. Zganjar 1981 24 p refs
(Contract DE-AS05-76ER-04935)
(ORO-4935-042) Avail: NTIS HC A02/MF A01

Investigations of individual nuclei and experimental techniques are briefly reported. The nuclei of (185)Au, (187)Au, (189)T1, (187)Hg, (189)Hg, (187)Pt, (121)(125)Cs, and (121)(127)In are addressed. DOE

N81-21902# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
COMPUTATIONAL METHODS FOR THE NUCLEAR AND NEUTRON MATTER PROBLEMS Progress Report
M. H. Kalos 1980 22 p refs
(Contract DE-AC02-79ER-10353)
(DOE/ER-10353/2) Avail: NTIS HC A02/MF A01

Progress on the development of Monte Carlo methods for the treatment of extensive nuclear and neutron matter and of finite nuclei is reported. Appropriate modifications in the Monte Carlo formalism were made and carried through for the V4 potential. Significant progress was made in the development of the Green's function Monte Carlo method for fermion systems.

It proved useful to study a model nuclear few-body problem, in particular, a kind of three-neutron problem. A stable Monte Carlo algorithm was developed. It gave correct results for energy and wave function for a soluble (separable) test problem and reasonalbe results (confirmed by variational computations) for a system interacting by pairwise phenomenological potentials. Methods for finding upper bounds have been devised in which Green's function methods are used. These have particular application to nuclear problems. Lower values of the upper bounds were gound for He. DOE

N81-21903# Oak Ridge National Lab., Tenn. Chemical Technology Div.
CHEMICAL ASPECTS OF NUCLEAR WASTE TREATMENT
W. D. Bond 1980 33 p refs Presented at the ACS Southeast-Southwest Reg. Meeting, New Orleans, 9-12 Dec., 1980
(Contract W-7405-eng-26)
(CONF-801226-2) Avail: NTIS HC A03/MF A01

The chemical aspects of the treatment of gaseous, liquid, and solid wastes are discussed in overview. In most streams, the radioactive elements are present in relatively low concentrations and are often associated with moderately large amounts of process, reagents, or materials. In general it is desirable that waste treatment methods are based on chemistry that is selective for the concentration of radionuclides and does not require the addition of reagents that contribute significantly to the volume of the treated waste. Solvent extraction, ion exchange, and sorbent chemistry play a major role in waste treatment because of the high selectivity provided for many radionuclides. DOE

74 OPTICS

Includes light phenomena.

N81-21904*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOURCES, CONTROL, AND EFFECTS OF NOISE FROM AIRCRAFT PROPELLERS AND ROTORS
John S. Mixson, George C. Greene, and Thomas K. Dempsey Apr. 1981 25 p refs Presented at the 1980 NASA Aircraft Safety and Operating Probl. Conf., Hampton, Va., 5-7 Nov. 1980 Submitted for publication
(NASA-TM-81971; L-14468) Avail: NTIS HC A02/MF A01 CSCL 20A

Recent NASA and NASA sponsored research on the prediction and control of propeller and rotor source noise, on the analysis and design of fuselage sidewall noise control treatments, and on the measurement and quantification of the response of passengers to aircraft noise is described. Source noise predictions are compared with measurements for conventional low speed propellers, for new high speed propellers (propfans), and for a helicopter. Results from a light aircraft demonstration program are considered which indicates that about 5 dB reduction of flyover noise can be obtained without significant performance penalty. Sidewall design studies are examined for interior noise control in light general aviation aircraft and in large transports using propfan propulsion. The weight of the added acoustic treatment is estimated and tradeoffs between weight and noise reduction are discussed. A laboratory study of passenger response to combined broadband and tonal propeller-like noise is described. Subject discomfort ratings of combined tone broadband noises are compared with ratings of broadband (boundary layer) noise alone and the relative importance of the propeller tones is examined. A.R.H.

N81-21905*# Institute for Atmosphere Optics and Remote Sensing, Hampton, Va.
SMALL-ANGLE APPROXIMATION TO THE TRANSFER OF NARROW LASER BEAMS IN ANISOTROPIC SCATTERING MEDIA Final Report
Michael A. Box and Adarsh Deepak Washington NASA Apr. 1981 47 p refs
(Contract NAS8-33135)
(NASA-CR-3407; M-345) Avail: NTIS HC A03/MF A01 CSCL 20F

The broadening and the signal power detected of a laser beam traversing an anisotropic scattering medium were examined using the small-angle approximation to the radiative transfer equation in which photons suffering large-angle deflections are neglected. To obtain tractable answers, simple Gaussian and non-Gaussian functions for the scattering phase functions are assumed. Two other approximate approaches employed in the field to further simplify the small-angle approximation solutions are described, and the results obtained by one of them are compared with those obtained using small-angle approximation. An exact method for obtaining the contribution of each higher order scattering to the radiance field is examined but no results are presented. A.R.H.

N81-21906*# Daedalus Enterprises, Inc., Ann Arbor, Mich.
DESIGN STUDY FOR THERMAL INFRARED MULTISPECTRAL SCANNER (TIMS) Final Report
C. G. Stanich, F. G. Osterwisch, D. M. Szeles, and W. H. Houtman 27 Mar. 1981 82 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955829)
(NASA-CR-164165; Rept-78004-01; JPL-9950-524) Avail: NTIS HC A05/MF A01 CSCL 20F

The feasibility of dividing the 8-12 micrometer thermal infrared wavelength region into six spectral bands by an airborne line scanner system was investigated. By combining an existing scanner design with a 6 band spectrometer, a system for the remote sensing of Earth resources was developed. The elements in the spectrometer include an off axis reflective collimator, a reflective diffraction grating, a triplet germanium imaging lens, a photoconductive mercury cadmium telluride sensor array, and the mechanical assembly to hold these parts and maintain their optical alignment across a broad temperature range. The existing scanner design was modified to accept the new spectrometer and two field filling thermal reference sources. A.R.H.

N81-21907# Defence Research Establishment Valcartier (Quebec).
SEGMENTATION ALGORITHMS FOR DETECTION OF TARGETS IN IR IMAGERY
L. Sevigny Jan. 1981 81 p refs
(AD-A095864; DREV-R-4180/81) Avail: NTIS HC A05/MF A01 CSCL 05/8

This report presents a class of segmentation algorithms (segmenters) for detection of targets in IR imagery based on the single assumption that the targets possess a larger thermal signature than the background. This class of algorithms emerged as a result of efforts to improve an early segmenter devised to extract targets from IR BOFORS imagery. This segmenter proceeds according to a Single Intensity Threshold, hence the name SIT Generator to designate it. The extraction record of the SIT Generator is generally excellent whenever the background, on a large-scale basis, is relatively uniform. When this condition is not met, one can use a thresholding intensity function in lieu of a fixed threshold. The SIT Generator and its variants try to cope with the background simply by partitioning the image. A more promising avenue consists in levelling the background so as to curb its ascendancy over the image. This is in essence what the Background Elimination Technique (BET) expounded herein does. Since BET can be applied either to the set of lines or columns of an image, it generates two images referred to as the Horizontal Fine Structure image and the Vertical Fine Structure image respectively. These images offer many possibilities for detection of targets and several of them are explicitly described in the report. GRA

N81-21908# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Inst. for Atmospheric Environmental Research.
SLANT PATH LOW VISIBILITY ATMOSPHERIC CONDITIONS Final Report, Jul. 1977 - Jul. 1980
Reinhold Reiter, Walter Carnuth, Rudolf Sladkovic, and Werner Funk Sep. 1980 133 p
(Grant DA-ERO-77-G-064; DA Proj. 1T1-61102-BG-57)
(AD-A096341) Avail: NTIS HC A07/MF A01 CSCL 20/14

A slant transmission path for measuring the quality of light transmission in the visible (0.35 to 0.90 micron) and thermal (1.25 to 12.75 micron) window has been installed. Transmitters

are located at 1650 m a.s.l. on a mountain peak, receivers at the valley institute where the signals (lower limit - 0, 1% transmission) are processed. Direct distance is 2.7 km, inclination of the path against horizon 19 deg. The following quantities are recorded at the mountain and also at the valley station: Precipitation rate, temperature, humidity, aerosol particle spectrum from 0.4 to 20 micron 0, and visibility. Profiles of temperature and humidity are recorded by sondes on one of the gondolas of a nearby cable car or by small radiosondes. Aerosol backscatter between valley and mountain station is recorded by a multi-frequency slant lidar (347 nm, 530 nm, and 694 nm, in near future also 1060 nm). This system serves to study in the course of measuring campaigns the dependence of light transmission on the meteorological situation (fog, precipitation, humidity) and on aerosol conditions mainly during moderate to strong haze or mist, as well as generally on the air mass type, particularly in cases of vertical inhomogeneity (layer structures). GRA

N81-21909# Tracor, Inc., Rockville, Md. Applied Sciences Dept.
EXPERIMENTAL MEASUREMENTS OF THE RATE OF CHANGE OF THE INDEX-OF-REFRACTION OF OPTICAL FIBER MATERIALS WITH RESPECT TO TEMPERATURE AND PRESSURE Final Report
V. Provenzano 22 Aug. 1980 37 p refs
(Contract N00014-78-C-0886)
(AD-A096229; TRACOR-T-81-RV-5031) Avail: NTIS HC A03/MF A01 CSCL 20/6

Laser interferometry was employed to determine the rate of change of the index of refraction with respect to temperature and pressure, the expansion coefficient and the compressibility of doped-silica glass samples for three types of dopants and different dopant concentration for a given dopant. Two fused silica samples were also included in the optical measurements to check the validity of the experimental method and to establish baseline values for the quantities being measured. Water was used as thermal bath for the temperature measurements and as the compressive fluid for the pressure measurements. GRA

N81-21910# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
INTELLIGENT TRACKING TECHNIQUES Quarterly Report, 1 Oct. - 31 Dec. 1979
Thomas J. Willett, Joseph Abruzzo, Vincent Zagardo, John Shipley, and Leo Kossa 28 Oct. 1980 95 p refs
(Contract DAAK70-78-C-0167)
(AD-A096317; QR-5) Avail: NTIS HC A05/MF A01 CSCL 17/5

This is the fifth quarterly report under a contract to investigate the design, test, and implementation of a set of algorithms to perform intelligent tracking and intelligent homing on FLIR and TV imagery. The system concept was described. The problem of target aspect determination in support of aimpoint selection was analyzed. Sequences of 875 line FLIR data were extracted from the data base and an example of aspect determination for a maneuvering target in the presence of obscurations was presented. An example was also presented for close in homing (less than 500 meters) and the emergence of interior features, target movement, and scale changes. Hardware implementation in terms of VLSI/VHSIC chips was analyzed. GRA

N81-21911# Tsukuba Univ. (Japan). Tandem Accelerator Center.
X-RAY PRODUCTION BY 5 MeV/amu DEUTERONS AND OXYGEN IONS; PROJECTILE-Z DEPENDENCE
W. Shearer-Izumi (United Nations Univ., Tokyo, Japan), M. Sasagase, M. Sato, and T. Mikumo 1979 21 p refs Submitted for publication
(UTTAC-21) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Five MeV/amu deuteron and oxygen ions were used to obtain K and L X-ray spectra from Cr, Fe, Cu, Ag, In and Sm targets. From these spectra, K beta/K alpha intensity ratios and K alpha and K beta X-ray energy shifts were determined for all targets, as well as the L beta/K alpha and L gamma/L alpha intensity ratios for Sm. An examination of the projectile-Z Z sub 1 dependence on the K beta/K alpha ratios of Ag, Cu and, for the most part, of Fe showed a linear relation for all known results. Both the K alpha and K beta energy shift for Fe were found to vary as Z sub 1 (3/2). R.C.T.

N81-21912# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
DESIGN AND DEVELOPMENT OF A LAMINATED FRESNEL LENS FOR POINT FOCUS PV SYSTEMS Final Report
Robert B. Hobbs, Jr. Jan. 1981 69 p refs Sponsored by DOE Prepared for Sandia Labs., Albuquerque, N. Mex.
(SAND-80-7137) Avail: NTIS HC A04/MF A01

The design and fabrication of a laminated Fresnel lens for point focus photovoltaic concentrators systems is described. The lens consists of a glass superstrate to which a thin 6.7 inch square Fresnel lens is bonded. Particular attention is given to the technical feasibility of injection molding acceptable quality Fresnel lenses. R.C.T.

N81-21913# European Space Agency, Paris (France).
DESCRIPTION AND UTILIZATION OF A COMPUTATION PROGRAM OF THE OPTICAL RADIATION TRANSMITTED, EMITTED OF DIFFUSED BY THE ATMOSPHERE FOR SATELLITE OBSERVATION
Anne-Marie Bouchardy and Jean-Claude Fontanella Mar. 1981 68 p refs Transl. into ENGLISH of "Description et Utilisation d'un Programme de Calcul du Rayonnement Opt. Transmis, Emis ou Diffuse par l'Atmosphere, a l'Usage de l'Observation par Satellite (Domaine Spectral 0.3-25 microns)" Rept. ONERA-NT-1980-3 ONERA, 1980 Original report in FRENCH previously announced as N81-12878
(ESA-TT-665; ONERA-NT-1980-3) Avail: NTIS HC A04/MF A01

A computer program RAVIR (radiation in the atmosphere in the visible and the infrared) which calculates the amount of radiation received by an observation satellite in a spectral range between 0.3 and 25 m is described. The program can be used for various sighting conditions and various positions of the sun relative to the satellite. The algorithms used for the calculation of the atmospheric transmittance are derived from the program LOWTRAN. Program RAVIR also calculates the thermal atmospheric luminance and the luminance due to scattered solar flux. Author (ESA)

N81-21914# Department of Health, Education, and Welfare, Rockville, Md. Division of Electronic Products.
OPTICAL RADIATION EMISSIONS FROM SELECTED SOURCES. PART 1: QUARTZ HALOGEN AND FLUORESCENT LAMPS Final Report
Kshitij Mohan, William Knight, Katherine W. Chen, Ian Lewin (Environmental Research Labs., Scottsdale, Ariz.), and Richard Heinisch (Environmental Research Labs., Scottsdale, Ariz.) Oct. 1980 241 p refs
(Contract FDA-223-76-6004)
(PB81-139693; DHHS/PUB/FDA-81-8136; FDA/BRH-81/3) Avail: NTIS HC A11/MF A01 CSCL 13A

Results of the first phase of a large scale screening of commonly used quartz halogen and fluorescent light sources are presented. Data reported include irradiance, illuminance, the effective irradiance, and spectral irradiance for each source measured. Also included is a detailed description of the spectroradiometer system developed to rapidly obtain the spectra data, a description of the test methods used, and an analysis of the uncertainties in the data. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-21915*# Los Alamos Scientific Lab., N. Mex.
ANISOTROPIC MAGNETOHYDRODYNAMIC TURBULENCE IN A STRONG EXTERNAL MAGNETIC FIELD
David Montgomery (College of William and Mary, Williamsburg, Va.) and Leaf Turner 1981 29 p refs
(Grant NsG-7416)
(NASA-CR-164185; LA-UR-80-2474) Avail: NTIS

HC A03/MF A01 CSCL 20I

A strong external dc magnetic field introduces a basic anisotropy into incompressible magnetohydrodynamic turbulence. The modifications that this is likely to produce in the properties of the turbulence are explored for the high Reynolds number case. The conclusion is reached that the turbulent spectrum splits into two parts: an essentially two dimensional spectrum with both the velocity field and magnetic fluctuations perpendicular to the dc magnetic field, and a generally weaker and more nearly isotropic spectrum of Alfven waves. A minimal characterization of the spectral density tensors is given. Similarities to measurements from the Culham-Harwell Zeta pinch device and the UCLA Macrotor Tokamak are remarked upon, as are certain implications for the Belcher and Davis measurements of magnetohydrodynamic turbulence in the solar wind. Author

N81-21916# Ohio State Univ., Columbus.
PRELIMINARY DESIGN PROCEDURE FOR HIGH POWER DENSITY MHD GENERATORS Final Report, Jun. - Aug. 1978
Pau-Chang Lu Wright-Patterson AFB, Ohio AFWAL Dec. 1980 37 p refs Sponsored by AF
(AD-A096144; AFWAL-TR-80-2077) Avail: NTIS HC A03/MF A01 CSCL 10/2

The steps to be taken in the preliminary design of a high power density, segmented Faraday or diagonal, open-cycle MHD generator are formalized. The recommended design procedure starts with the optimum choice of the combustion chamber pressure. The optimization is based on a semi-empirical expression of the effective power density, developed by Smith and Nichols. As a result of this optimization, a rough estimate of the realizable power density is made, which yields the order of magnitude of the transverse dimension keeping the length-to-diameter ratio around 10 for the desired power output. It is then recommended that the area variation and length be calculated on the basis of an isothermal core flow. This preliminary shape of the duct will serve as the base on which alterations can be made by a computer to accommodate wall effects in detailed design stage that will follow the preliminary consideration. An alternate route for the preliminary design is provided by using scaling laws. Starting with a well-designed generator which is demonstrably high in power density, dynamically similar units can be produced using these laws. The laws are developed following the modern procedure of ordering. Numerical examples are provided to illustrate the procedure. GRA

N81-21917# Naval Research Lab., Washington, D. C.
ABLATED PLASMA FLOW FROM PLANAR TARGETS
M. J. Herbst and J. Grun 13 Mar. 1981 14 p refs
(AD-A096115; NRL-MR-4436) Avail: NTIS HC A02/MF A01 CSCL 20/9

The experimentally observed flow of plasma ablated by a laser from a planar target resembles the nozzle flow of fluid from a circular orifice. This has implications for experimental simulations of spherical laser fusion pellets using planar targets and affects far field ion measurements in planar geometry experiments. GRA

N81-21918# Illinois Univ. at Urbana. Fusion Studies Lab.
RESTRIKE PARTICLE BEAM EXPERIMENTS ON A DENSE PLASMA FOCUS Annual Report, 30 Sep. 1979 - 30 Sep. 1980
Glenn Gerdin 30 Nov. 1980 66 p refs
(Grant AF-AFOSR-0121-79; AF Proj. 2301)
(AD-A095865; AFOSR-81-0184TR) Avail: NTIS HC A04/MF A01 CSCL 20/9

Particle beam diagnostic tools have been developed to study the particle beams generated by a dense plasma focus device (DPF). These tools include an ion Faraday cup, solid state nuclear track detectors, electron beam Rogowski coils, an electron beam Faraday cup, and an electron beam magnetic spectrometer. Electron and ion energy spectras of the accelerated electron and ion beams have been measured using the above tools and it is found that the number of particles per unit energy obey a power law with particle energy for both types of particles. Parallel plate coupling between the DPF device and the capacitor bank appears to result in superior DPF performance in terms of neutron yield. The application of the results of this research to opening switch technology is discussed. GRA

N81-21919# McElroy (Ralph) Co., Austin, Tex.
MAX PLANCK INSTITUTE FOR PLASMA PHYSICS
Brigitte Rothlein and Uwe Schumacher Aug. 1980 114 p Transl. into ENGLISH of "Max-Planck-Gesellschaft zur Foerderund der Wissenschaften Berichte und Mitteilungen" Max Planck Inst. for Plasma Physics, West Germany, 1977 Prepared for LASL
(Contract W-7405-eng-36)
(LA-tr-80-25) Avail: NTIS HC A06/MF A01

Some insight is provided on the various problems that are encountered on the road towards development of a fusion reactor. Several important experimental systems are described as well as solutions to the difficult physical and technical problems. R.C.T.

N81-21920# Gilbert/Commonwealth, Reading, Pa.
OXYGEN-ENRICHED AIR PRODUCTION FOR MHD POWER PLANTS
May 1980 46 p refs
(Contracts DE-AC01-77ET-11058; ET-78-C-01-2683)
(DOE/ET-11058/T4) Avail: NTIS HC A03/MF A01

An analysis of several of the cryogenic air separation process cycle variations and compression schemes designed to minimize net system power requirements for supplying pressurized, oxygen-enriched air to the combustor of a 2000 MWt (coal input) baseload MHD power plant is presented. DOE

N81-21921# Los Alamos Scientific Lab., N. Mex.
AMPLIFIED REFLECTION VIA DEGENERATE FOUR-WAVE MIXING IN A LASER INDUCED FREE CARRIER PLASMA IN GERMANIUM
D. E. Watkins, C. R. Phipps, Jr., and S. J. Thomas 1981 6 p refs Presented at the Intern. Conf. on Excited States and Multiresonance Nonlinear Opt. Process in Solids, Modane, France, 18-20 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3528; CONF-810312-1) Avail: NTIS HC A02/MF A01

The first observation of amplified reflection at CO2 laser wavelengths via degenerate four-wave mixing in an optically induced free-carrier plasma in germanium is presented. Reflectivities of over 100% are reported in both n-type and p-type Ge. A model is presented which predicts both the magnitude and the I(2) intensity dependence of the reflectivity from the free carrier plasma density. This density is determined experimentally by time-resolving the incident and transmitted signals obtained above the plasma formation threshold and deducing the free carrier density via a detailed model which relates this quantity to the instantaneous, intensity-dependent transmission. DOE

N81-21922# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
NONLINEAR SATURATION OF THE LOWER-HYBRID-DRIFT INSTABILITY
J. R. Myra and R. E. Aamodt Nov. 1980 12 p refs
(Contract DE-AC03-76ET-53057)
(SAI-254-80-650-LJ; PRI-19) Avail: NTIS HC A02/MF A01

The nonlinear evolution of the lower-hybrid-drift instability is considered in the guiding-centers-on-axis model. Extremely rapid quasilinear diffusion of electrons leads to the buildup of a radial electric field, vector E sub r. Saturation occurs when the vector E sub r x vector B electron drift velocity equals the local ion rotational velocity. Due to the rapid linear growth rate, the unmagnetized ions here are unable to shield out vector E sub r, which becomes significant long before density profile flattening occurs. DOE

N81-21923# Argonne National Lab., Ill.
STARFIRE: A COMMERCIAL TOKAMAK FUSION POWER PLANT STUDY, VOLUME 1
Sep. 1980 859 p refs Prepared in cooperation with McDonnell-Douglas Astronautics Corp., St. Louis, Mo., General Atomic Corp. and Parsons (Ralph M.) Co., Los Angeles, Calif.
(Contract W-31-109-eng-38)
(ANL/FPP-80-1-Vol-1) Avail: NTIS HC A99/MF A01

The development of the STARFIRE 1200 MWe central station

fusion electric power plant is discussed. Emphasis was placed on developing design features which will provide for simpler assembly and maintenance, and improved safety and environmental characteristics. A comprehensive conceptual design was developed including reactor features, support facilities and a complete balance of plant. A construction schedule and cost estimate were also determined, as study conclusions and recommendations. DOE

N81-21924# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
FUSION SAFETY PROGRAM PLAN
J. G. Crocker, Douglas F. Holland, J. Stephen Herring, Sydney Cohen, Steven E. Jones, Glen R. Longhurst, James N. McBride, Brad J. Merrill, Paul A. Roth, Richard E. Schmunk et al Sep. 1980 203 p refs
(Contract DE-AC07-76ID-01570)
(EGG-FSP-5238) Avail: NTIS HC A10/MF A01

The program plan is described which consists of research divided into 13 different areas. These areas focus on the radioactive inventories that are expected in fusion reactors, the energy sources potentially available to release a portion of these inventories, and analysis and design techniques to assess and ensure that the safety risks associated with operation of magnetic fusion facilities are acceptably low. Both long-term program requirements that must be fulfilled as part of the commercialization of fusion power and a five year plan for each of the 13 different program areas are presented. Also presented is a general discussion of magnetic fusion reactor safety, a method for establishing priorities in the program, and specific priority ratings for each task in the five year plan. DOE

N81-21925# Sandia Labs., Albuquerque, N. Mex.
A PARAMETERIZATION OF X-RAY PRODUCTION IN LASER-PRODUCED PLASMAS
James M. Peek Oct. 1980 43 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0968) Avail: NTIS HC A03/MF A01

A simple and algebraically tractable model was developed for the efficiency of X-ray production in a certain spectral region by laser driven plasmas. The model was used as an interpolation/extrapolation device for experimental and theoretical results from three different target concepts. Results indicate that it is of use in its intended capacity. Certain relationships between independent parameters and scaling laws also result from this construction. Most notable among these is the prediction that the efficiency for producing line radiation in a certain narrow energy range scales like the inverse square of this energy. R.C.T.

N81-21926# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
KINETIC EFFECTS ON BALLOONING MODES IN MIRROR MACHINES
W. M. Tang (Princeton Univ.) and P. J. Catto Dec. 1980 22 p refs
(Contract DE-AC03-79ET-53057)
(SAI-254-80-594-LJ; PRI-15) Avail: NTIS HC A02/MF A01

A general procedure for examining the influence of kinetic effects on the stability of magnetohydrodynamic ballooning modes in mirror machines is presented. In particular, the basic kinetic ballooning mode equation for a nonaxisymmetric, arbitrary beta system with anisotropic pressure is derived. Considering a long thin equilibrium typical of the tandem mirror, it is shown that this governing eigenmode equation reduces to a simple form independent of wave particle resonant effects. R.C.T.

N81-21927# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
A DIAGNOSTIC FOR TIME-RESOLVED SPATIAL PROFILE MEASUREMENTS ON THE ION TEMPERATURE ON JOINT EUROPEAN TORUS (JET)
H. J. B. M. Brocken and H. W. vanderVen May 1980 26 p refs Sponsored by Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and Euratom
(Rept-80-123) Avail: NTIS HC A03/MF A01

A neutral particle scattering experiment for a continuous measurement of the ion temperature and ion density of the JET plasma in the hydrogen and deuterium phase is proposed. Space and time resolved measurements are possible by injection of a mono-energetic particle beam into the plasma and from the analysis of the velocity distribution of the scattered particles. The requirements on the injection system are specified and a suitable analyzer system is described. Author (ESA)

N81-21928# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
THE EFFECT OF AN IRON CORE ON THE STABILITY OF A CURRENT-CARRYING PLASMA: APPLICATION TO RINGBOOG 2
A. C. A. vanWees, L. C. J. M. deKock, and P. Manintveld Sep. 1980 37 p refs Sponsored by Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and Euratom
(Rept-80-126) Avail: NTIS HC A03/MF A01

A practical solution is given for realizing the poloidal field of a Tokamak plasma situated very close to an iron core. For the geometry of RINGBOOG 2 the expanding force of the toroidal current-carrying plasma is nearly compensated by the magnetic force generated by the stray field of the iron core. This field configuration is very unstable for horizontal plasma displacements. An external field is proposed which mainly compensates the unfavorable gradient of the vertical field, and to a lesser extent, gives the right position. Author (ESA)

N81-21929# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
THE CRITICAL IONIZATION VELOCITY
Michael A. Raadu Jun. 1980 12 p refs Presented at Intern. Workshop on Relation Between Lab. and Space Plasmas, Tokyo, 14-15 Apr. 1980 Sponsored by Swedish National Science Research Council
(TRITA-EPP-80-50; ISSN-0348-7539) Avail: NTIS HC A02/MF A01

The critical ionization velocity effect is discussed in the context of space plasmas. This effect occurs for a neutral gas moving through a magnetized plasma and leads to rapid ionization and braking of the relative motion when a certain marginal velocity, the critical velocity, is exceeded. Laboratory experiments clearly establish the significance of the critical velocity and provide evidence for an underlying mechanism dependent on the combined action of electron impact ionization and collective plasma interaction heating of electrons. There is experimental support for such a mechanism based on the heating of electrons by the modified two-stream instability as part of a feedback process. Several applications to space plasmas are proposed; the possibility of space experiments is discussed. Author (ESA)

N81-21930# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
CROSS-HELICITY EFFECTS IN ANISOTROPIC MAGNETO-HYDRODYNAMIC TURBULENCE
P. Veltri (Calabria Univ., Italy), A. Mangeney (Observatoire de Meudon, France), and M. Dobrowolny Nov. 1980 14 p refs (LPS-80-18) Avail: NTIS HC A02/MF A01

A closed set of statistical equations is established for incompressible magnetohydrodynamic (MHD) turbulence in the presence of a background magnetic field and for the general case of nonzero cross helicity. The basic constraints of realizability and invariance with respect to random Galilean transformations are realized through the use of a random phase hypothesis which allows the introduction of the Alfven effect. The equations derived point to a tendency in the anisotropic MHD turbulence to relax towards a state where all the turbulent eddies correspond to a given sign of cross helicity. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-21931*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
CRYSTAL GROWTH OF DEVICE QUALITY GaAs IN SPACE Annual Report, 1 Apr. 1980 - 31 Mar. 1981

Jacek Lagowski Apr. 1981 39 p refs
(Grant NsG-7331)
(NASA-CR-164187) Avail: NTIS HC A03/MF A01 CSCL 20L

Experimental and theoretical efforts in the development of crystal growth approaches, effective techniques for electronic characterization on a macro and microscale, and in the discovery of phenomena and processes relevant to GaAs device applications are reported. The growth of electron trap-free bulk GaAS with extremely low density of dislocations is described. In electroepitaxy, growth configuration which eliminates the substrate back-contact was developed. This contiguration can be extended to the simultaneous growth on many substrates with a thin solution layer sandwiched between any two of them. The significant reduction of Joule heating effects in the configuration made it possible to realize the in situ measurement of the layer thickness and the growth velocity. Utilizing the advantages of electroepitaxy in achieving abrupt acceleration (or deceleration) of the growth it was shown that recombination centers are formed as a result of growth acceleration. M.G.

N81-21932# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INP MATERIALS Annual Technical Summary Report, 1 Oct. 1979 - 30 Sep. 1980
Gerald W. Iseler 30 Sep. 1980 20 p refs
(Contract F19628-80-C-0002; AF Proj. 2306)
(AD-A096006; ESD-TR-80-231) Avail: NTIS
HC A02/MF A01 CSCL 20/2

This report covers the work on InP materials carried out with support of the Department of the Air Force during the period 1 October 1979 through 30 September 1980. A part of this support was provided by the Rome Air Development Center. More than half of the synthesized polycrystalline ingots have exhibited mobilities at 77 K greater than 5 x 10,000/sq cm/V/sec. From our study of the LEC growth of over 100 InP boules we have found that a high yield of twin-free crystals can be achieved if the axial temperature gradient at the melt interface exceeds a certain minimum value. GRA

N81-21933# Pennsylvania State Univ., University Park. Materials Research Lab.
SINGLE CRYSTAL SUBSTRATES FOR SURFACE ACOUSTIC WAVE DEVICES Final Technical Report, 1 Jan. 1979 - 30 Jun. 1980
G. R. Barsch and K. E. Spear Jan. 1981 63 p refs
(Contract F19628-79-C-0036; AF Proj. 2305)
(AD-A096375; RADC-TR-80-398) Avail: NTIS
HC A04/MF A01 CSCL 20/2

In order to search for new temperature compensated materials for surface acoustic wave (SAW) devices with low ultrasonic attenuation and high electromechanical coupling, the following experimental and theoretical investigations were carried out: (1) Crystal growth research centered around: designing, constructing, and writing the software for a computer controlled constant-diameter attachment for our Czochralski crystal pullers; a major experimental effort on the growth of lead potassium niobate (PKN); Pb2KNb5O15, and lead bismuth niobate (PBN) PbBi2Nb2O9, and a minor experimental effort on the growth of lithium metasilicate, Li2SiO3; and bismuth molybdate, Bi2MoO6. (2) The dielectric constants and the associated loss tangents of alpha-berlinite were measured at eleven frequencies from 100 to 10,000 Hz between -150 and 200 C. The temperature dependence of the dielectric constants and the relaxation behavior are similar to the results obtained earlier, but the absolute values are 20 to 30 percent smaller than reported previously. (3) The temperature dependence of the two shear modes propagating in (001) has been measured from 10 to 315K for Bi4Ti3O12. A monotonical decrease of the associated shear moduli has been found. (4) Considerable effort was devoted to specimen preparation of lead bismuth niobate which was hampered by the easy cleavage of this material perpendicular to < 001 >. GRA

N81-21934# Stanford Univ., Calif. Center for Materials Research.
A FEASIBILITY STUDY ON THE GROWTH OF BULK GaN SINGLE CRYSTALS
W. A. Tiller, R. S. Feigelson, and D. Elwell Oct. 1979 11 p refs
(Contract N00019-79-C-0327)
(AD-A095981; CMR-79-9; QR-1) Avail: NTIS
HC A02/MF A01 CSCL 20/2

In addition to problems of multinucleation, low solubility, and slow convection experienced in earlier experiments, it is postulated that the solubility of GaN in gallium follows a reciprocal temperature dependence. In spite of this handicap, it has been found possible to achieve conditions under which the nucleation of GaN is reduced in comparison to previous experiments and so to produce larger GaN crystals. The major aim of experiments in the near future will be to obtain a more complete understanding of the conditions required to produce large crystals of GaN.GRA

N81-21935# Illinois Univ. at Urbana. Dept. of Electrical Engineering.
NEAR MILLIMETER WAVE LOCAL OSCILLATOR SOURCES Interim Report, 1 Jun. - 31 Dec. 1980
Paul D. Coleman Feb. 1981 17 p
(Contract DAAK70-80-C-0066)
(AD-A096141; UILU-ENG-81-2540) Avail: NTIS
HC A02/MF A01 CSCL 20/12

This report describes research on proof of principle that a AlGaAs-GaAs heterostructure can display a negative differential resistance suitable for constructing an oscillator operating in the 100 GHz range. The conjecture is that if the electrons in the GaAs layer are heated by the application of an electric field parallel to the layer interface, they can be made to return to their parent donors in the Si doped AlGaAs layer where their mobilities are much smaller than in the GaAs. GRA

N81-21936# University of Southern California, Los Angeles.
SEMICONDUCTOR PROPERTIES NEAR INTERFACES Final Report, 1 Aug. 1977 - 31 Jul. 1980
D. B. Wittry, S. Y. Yin, and F. Guo 31 Jul. 1980 11 p refs
(Grant AF-AFOSR-3419-77; AF Proj. 2308)
(AD-A095858; AFOSR-81-0156TR) Avail: NTIS
HC A02/MF A01 CSCL 20/12

Surface layers on GaAs were studied using cathodoluminescence and secondary ion mass spectrometry. The layers studied included thermally-converted layers formed on semi-insulating GaAs using various heat treatments, and oxides grown by anodizing in aqueous and non-aqueous electrolytes. Some of the investigations required improvements in the Ion Microprobe Mass Analyzer; in the course of the investigations an improved ion detector was developed and a microcomputer-based automation system was constructed. GRA

N81-21937# Argonne National Lab., Ill.
WORKSHOP ON ARTIFICIAL SUPERLATICES
1980 42 p Conf. held at Urbana, Ill., 30-31 Oct. 1980
(Contract W-31-109-eng-38)
(ANL-80-101; CONF -8010133) Avail: NTIS
HC A03/MF A01

Artificial superlattic materials are discussed. Specifically, structure and elastic properties, transport and electronic properties, magnetism and superconductivity, and phonons are addressed. DOE

N81-21938# Illinois Univ., Urbana. Dept. of Ceramic Engineering.
CHARACTERIZATION OF INTERNAL BOUNDARY LAYER CAPACITORS BASED UPON BARIUM TITANATE AND STRONTIUM TITANATE Ph.D. Thesis
Hyun Duk Park 1981 108 p refs
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198-1340) Avail: NTIS HC A06/MF A01

The nature of ceramic microstructure and the electrical properties of individual grains and junctions was determined by STEM, microprobe analysis and microscale electrical measurements. The chemical compositions of the resistive boundary regions were different from those of the grains. Additives were concentrated in the boundary regions, forming resistive layers. Limited diffusion of the counterdopants into the grain subsurface formed an interfacial compensation layer between the insulating intergranular layer and the semiconducting grains. The electrical behavior of this intermediate layer was found to be similar to that of a depletion layer. Ceramic microstructures was approximated by a three-layer n-c-i-c-n model and representive equivalent

circuit, which was used to explain the voltage dependence of the dielectric constant and dispersion behavior. Fine grain microstructures developed by liquid phase sintering techniques were suitable for high dielectric constant multilayer capacitors, based upon internal boundary layer phenomena, and these capacitors and stable dielectric characteristics. DOE

N81-21939# Missouri Univ. -Rolla.
DEVELOPMENT AND CHARACTERIZATION OF HIGH TEMPERATURE ELECTRICALLY CONDUCTING OXIDES Progress Report, 1 Apr. 1980 - 28 Feb. 1981
H. U. Anderson and C. A. Sorrell Nov. 1980 7 p
(Contract DE-AC02-80ER-10598)
(DOE/ER-10598/1) Avail: NTIS HC A02/MF A01

The interrelationships between electrical conductivity, oxidation-reduction kinetics, defect structure, and composition for n-type and p-type binary and ternary transition metal oxides were studied. The experimental aspects included specimen preparation, thermogravimetric measurements, X-ray diffraction, transmission electron microscopy, electrical conductivity, and Seebeck measurements. The initial thrust was devoted to equipment fabrication and sample preparation. R.C.T.

N81-21940# Los Alamos Scientific Lab., N. Mex.
BRILLOUIN-ZONE INTEGRATION SCHEMES: AN EFFICIENCY STUDY FOR THE PHONON FREQUENCY MOMENTS OF THE HARMONIC, SOLID, ONE-COMPONENT PLASMA
R. C. Albers and J. E. Gubernatis Jan. 1981 25 p refs
(Contract W-7405-eng-36)
(LA-8674-MS) Avail: NTIS HC A02/MF A01

The efficiency of four different Brillouin-zone integration schemes including the uniform mesh, special point method, special directions method, and Holas method are compared for calculating moments of the harmonic phonon frequencies of the solid one-component plasma. Very accurate values for the moments are also presented. The Holas method for which weights and integration points can easily be generated has roughly the same efficiency as the special directions method, which is much superior to the uniform mesh and special point methods for this problem. DOE

N81-21941# Stanford Univ., Calif. Center for Materials Research.
GROWTH OF HIGH PHASEMATCHED TEMPERATURE LiNbO3 SINGLE CRYSTALS AND APPLICATION TO EFFICIENT SECOND HARMONIC GENERATION OF Nd:YAG Final Report
R. L. Byer, Yong Kwan Park, Robert S. Feigelson, and Wayne L. Kway Aug. 1980 36 p refs
(Contract W-7405-eng-48)
(UCRL-15310) Avail: NTIS HC A03/MF A01

It was demonstrated that LiNbO3 crystals with a phasematching temperature greater than 1800 C can be grown with small concentration gradients from a melt doped with MgO and excess Li2O together with a planar growth interface; that the phasematch temperature can be readily adjusted simply by changing the excess Li2O concentration proportional to the phasematch temperature desired; that the crystal quality and SHG characteristics can be maintained as long as the MgO concentration and growth parameters are held constant. It was also found that the self-annealing temperature is much lower, near 1200 C for the Stanford grown crystals, as compared to the previously reported value of 170 C to 1800 C. Taking advantage of the lower self-annealing temperature, the crystals grown with phasematching temperature of approximately 1200 C showed exceptional optical homogeneity, and a 40% average power SHG conversion efficiency. The improved hot phasematching LiNbO3 crystals along with the electro-optical or piezo-optical compensation for self heating effects should greatly enhance crystal device applications to high average power second harmonic generation of the Nd:YAG source. DOE

N81-21942# Los Alamos Scientific Lab., N. Mex.
LASL Nb3Ge CONDUCTOR DEVELOPMENT Progress Report, 1 Jul. - 30 Sep. 1980
J. D. Thompson 30 Sep. 1980 9 p refs Sponsored by DOE
(LA-8646-PR; QPR-17) Avail: NTIS HC A02/MF A01

The development of Nb3Ge as a superconductor with potential applications to power transmission lines is discussed. Tests on a 1 m Nb3Ge-based cable were performed. These tests consisted of measurements of ac loss as a function of 60 Hz current through the cable at various fixed temperatures between 7.5 and 14.5 K and of quench current as a function of temperature. Losses measured on the cable were high, 1 mW/sq cm at 500 rms A/cm, and comparable to losses in similar 1 m Nb3Sn-based cables. Likewise, the quench current was unexpectedly low. It is believed that these observations are not a result of the Nb3Be superconducting properties. M.G.

N81-21943# Siemens A.G., Munich (West Germany). Abteilung fuer Festkoerperelektronic.
VAPOR PHASE EPITAXIAL INDIRECT BAND GAP GaAs(1-x) P(x) LED'S ON GaP-SUBSTRATE Final Report
Klaus Schwarzmichel Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 65 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-019; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

Transparent substrate nitrogen, Ga(As P) n-type LED's were fabricated, using a vapor phase epitaxial process and a low temperature Zn diffusion process. The experimental techniques and the investigation methods are described. The dependence of the properties of the epitaxial layers and of the diodes on the process parameters are discussed. As a result of their high optical coupling efficiency, which is due to the GaP substrate transparency to the emitted radiation, the brighness of reddish orange and yellow emitting Ga(As P) n-type LED's exceeds that of conventional red emitting GaAs(0.6) P(0.4) LED's by a factor of 3 to 5. The maximum external quantum efficiencies at 350 A/52 cm for reddish orange and yellow emitting diodes are 0.8% and 0.3%, respectively. Author (ESA)

N81-21944# Stuttgart Univ. (West Germany). Physikalisches Inst.
CRYSTAL GROWTH OF 3-5 SEMICONDUCTORS BY THE TRAVELING-HEATER-METHOD WITH RESPECT TO MICROGRAVITY Final Report
Klaus-Werner Benz, Georg Mueller (Erlangen-Nuernberg Univ., West Germany), and Herbert Weiss (Erlangen-Nuernberg Univ., West Germany) Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 58 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-24; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

The preparation of the spacelab experiment WV 136 (ES 323) ATHM of group 3 - 5 semiconductors under reduced gravity is described. Gallium antimony was used as a model group 3 - 5 semiconductor material for the first spacelab mission. The solution temperature was fixed at 500 C, the growth velocity not to exceed 3 to 4 mm/day. Various growth experiments were carried out in a mirror furnace facility. The preliminary experimental program of the first spacelab mission was worked out. Three GaSb samples were prepared with the engineering model. It is demonstrated that THM can be taken as a useful method to grow crystals of group 3 - 5 compounds with low dislocation densities and the quality of liquid epitaxial layers. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N81-21945# Naval Postgraduate School, Monterey, Calif.
TEMPERATURE DEPENDENCE OF GAS PROPERTIES IN POLYNOMIAL FORM

J. R. Andrews and Oscar Biblarz Jan. 1981 132 p refs
(AD-A096388; NPS67-81-001) Avail: NTIS HC A07/MF A01 CSCL 20/13

Based on a least-squares polynomial approximation, a procedure is introduced for calculating existing tabular values of thermodynamic and transport properties for common gases. The specific heat at constant pressure is given for 238 gases, the thermal conductivity for 55 gases, the dynamic viscocity for 58 gases, and the second and third virial coefficients for 14 gases. At sufficiently low pressures, ideal gas behavior prevails and temperature may be used as the single independent variable. The algorithm for nested multiplication is presented, optimized for hand-held or desktop electronic calculators. Using the polynomial approximations and a suitable calculator, it is possible to duplicate existing reference source tabular values directly, obviating the need for interpolation or further reference to the tables per se. The accuracy of the calculated values can be within 0.5% of the tabular values. The polynomial coefficients are given in the International System of Units (SI). Methods are presented to calculate the temperature corresponding to a given property value. Extrapolation features of the polynomials are discussed. GRA

N81-21946# Los Alamos Scientific Lab., N. Mex.
THE ARROW OF TIME IN THE DYNAMIC THEORY
Pharis E. Williams Feb. 1981 10 p refs
(LA-8690-MS) Avail: NTIS HC A02/MF A01

A theory is proposed which adopts generalizations of the classical laws of thermodynamics as the basis for a view of all physical phenomena. The theory requires an asymmetry in time for systems whose Newtonian or relativistic description is symmetrical. This is accompanied with the prediction that the universe must forever grow older and continually expand and provides insight on the extreme red shift of quasars. M.G.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-21947# Sandia Labs., Albuquerque, N. Mex. Energy Research and Development.
NETWORK ANALYSIS PLANNING FOR PROJECT MANAGEMENT: A PRIMER
Marvin J. Becktell Jan. 1981 33 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1654) Avail: NTIS HC A03/MF A01

A step-by-step description of a methodology for planning a project using techniques of network analysis is reviewed. The methods are compatible with most available computer planning programs. Simple workshop problems and solutions are included. S.F.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-21948*# Stanford Univ., Calif. Program in Information Policy.
IMPROVING NASA'S TECHNOLOGY TRANSFER PROCESS THROUGH INCREASED SCREENING AND EVALUATION IN THE INFORMATION DISSEMINATION PROGRAM
Horstfried Laepple Oct. 1979 58 p refs
(Contract NASw-3204)
(NASA-CR-164176; Rept-28) Avail: NTIS HC A04/MF A01 CSCL 05B

The current status of NASA's technology transfer system can be improved if the technology transfer process is better understood. This understanding will only be gained if a detailed knowledge about factors generally influencing technology transfer is developed, and particularly those factors affecting technology transfer from government R and D agencies to industry. Secondary utilization of aerospace technology is made more difficult because it depends on a transfer process which crosses established organizational lines of authority and which is outside well understood patterns of technical applications. In the absence of a sound theory about technology transfer and because of the limited capability of government agencies to explore industry's needs, a team approach to screening and evaluation of NASA generated technologies is proposed which calls for NASA, and other organizations of the private and public sectors which influence the transfer of NASA generated technology, to participate in a screening and evaluation process to determine the commercial feasibility of a wide range of technical applications. A.R.H.

N81-21949*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH AND TECHNOLOGY: ANNUAL REPORT Annual Report
1980 62 p
(NASA-TM-82314) Avail: NTIS HC A04/MF A01 CSCL 05B

Activity conducted in the following areas is highlighted: space sciences, space transportation systems, space and energy technology, and space terrestrial applications. A.R.H.

N81-21950*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A REVIEW AND EVALUATION OF THE LANGLEY RESEARCH CENTER'S SCIENTIFIC AND TECHNICAL INFORMATION PROGRAM. RESULTS OF PHASE 5. DESIGN AND EVALUATION OF STI SYSTEMS: A SELECTED, ANNOTATED BIBLIOGRAPHY
Thomas E. Pinelli, Patricia A. Hinnebusch (Old Dominion Univ.), and Jack M. Jaffe Feb. 1981 78 p
(NASA-TM-81954) Avail: NTIS HC A05/MF A01 CSCL 05B

A selected, annotated bibliography of literature citations related to the design and evaluation of STI systems is presented. The use of manual and machine-readable literature searches; the review of numerous books, periodicals reports, and papers; and the selection and annotation of literature citations were required. The bibliography was produced because the information was needed to develop the methodology for the review and evaluation project, and a survey of the literature did not reveal the existence of a single published source of information pertinent to the subject. Approximately 200 citations are classified in four subject areas. The areas include information - general; information systems - design and evaluation, including information products and services; information - use and need; and information - economics. A.R.H.

N81-21951*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TECHNICAL WRITING: PAST, PRESENT AND FUTURE
J. C. Mathes, comp. (Michigan Univ., Ann Arbor) and Thomas E. Pinelli, comp. Mar. 1981 62 p refs Papers presented at the 32d Ann. Conf. on Coll. Composition and Commun., sessions A-6 and 1-11, Dallas, 26-28 Mar. 1981
(NASA-TM-81966) Avail: NTIS HC A04/MF A01 CSCL 05B

The training of technical writers and the objectives of such education are discussed. Special emphasis was placed on the

communication between technical personnel and non-technical personnel. The liabilities that affect technical writers were also discussed. For individual titles, see N81-21952 through N81-21959.

N81-21952*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MARKETING INFORMATION: THE TECHNICAL REPORT AS PRODUCT
Freda F. Stohrer (Old Dominion Univ.) and Thomas E. Pinelli *In its* Tech. Writing: Past, Present and Future Mar. 1981 p 5-16 refs (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

The present environment of the technical report is vast, with considerable variance in report components, format, and organization. As part of the Langley Scientific and Technical Information (STI) Review and Evaluation Project, a review of the technical report as an effective product for information communication was undertaken. Style manuals describing theory and practice in technical report preparation; publication manuals covering such factors as design, layout, and type style: and copies of technical reports were obtained from industrial, academic, governmental, and research organizations. T.M.

N81-21953*# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
THE NATURE AND TREATMENT OF PROFESSIONAL ENGINEERING PROBLEMS: THE TECHNICAL WRITING TEACHER'S RESPONSIBILITY
Ben F. Barton and Marthalee Barton *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 17-29 refs (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

Two general pedagogical responses among technical communication instructors were examined: the denial of responsibility for assessing the professional caliber of a student's treatment of a technical problem; and turning the rhetoric instructor's lack of technical expertise into a virtue. The differences between the textbook problems addressed by students and the problems addressed by professionals were determined. Suggestions for a more effective training method are presented. T.M.

N81-21954*# Pittsburg State Univ., Kans.
TECHNICAL WRITING IN AMERICA: A HISTORICAL PERSPECTIVE
Michael E. Connaughton *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 31-41 refs (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

The practice of technical writing is described in the earliest phase, from the beginning in the seventeenth century until approximately 1815, when specializations begin to coalesce around professional organizations and specialized journals. Emphasis is placed on those traits that technical writing has in common with all species of composition. T.M.

N81-21955*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Language, Literature and Communication.
TECHNICAL COMMUNICATION: NOTES TOWARD DEFINING A DISCIPLINE
Philip M. Rubens *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 43-49 refs (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

The view that technical writing is any writing that supports technology or technological activities was examined. An empirical methodology that reaches into communicology, contemporary discourse theory, and even ethics was developed which offers a way for defining audiences, purposes, and by extension, the domain of technical communication. T.M.

N81-21956*# Rice Univ., Houston, Tex.
TRENDS IN LIABILITY AFFECTING TECHNICAL WRITERS
L. P. Driskill *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 51-62 refs (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

Legal background is provided and several liability prevention programs are described. The basic rules that govern the duty of manufacturers or sellers to warn of product-related dangers are summarized and include who must warn, who must be warned, and what dangers must be explained. The future responsiblities of technical writers are discussed. T.M.

N81-21957*# Houston Baptist Univ., Tex. Dept. of Languages.
HOW DO TECHNICAL AND NON-TECHNICAL PERSONNEL COMMUNICATE?
June Ferrill *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 63-68 (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

An interview model which facilitates communications between technical and non-technical personnel was developed. It outlines the elements of understanding technical material. Several communication problems were examined and included: how technical writers view the writing process; and whether persons with technical backgrounds view the writing process differently from those with non-technical backgrounds. T.M.

N81-21958*# Washington Univ., Seattle. School of Law.
A PROBLEM OF IDENTITY: WHO ARE YOU WHEN YOU'RE BEING WELL PAID FOR IT?
Lynn B. Squires *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 69-73 (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

The social factors affecting the transition of English teachers into technical writing consultants are discussed. The basis for a new self-image is described and several principles of successful consulting are summarized. Major emphasis is on personnnel development and personal development. T.M.

N81-21959*# Michigan Univ., Ann Arbor. Dept. of Humanities.
ASSUMING RESPONSIBILITY: AN AFFECTIVE OBJECTIVE IN TEACHING TECHNICAL WRITING
J. C. Mathes *In* NASA. Langley Research Center Tech. Writing: Past, Present and Future Mar. 1981 p 75-78 refs (For primary document see N81-21951 12-82)
Avail: NTIS HC A04/MF A01 CSCL 05B

A two step process by which a technical writer assumes responsibility for the consequences of a report is discussed. First, the professional must formulate the conclusions and recommendations implicit in his or her technical analysis. Second, the professional must ensure that these are acted upon as necessary. Examples are presented which show the consequences of technical writers failing to assume responsibility for reports. T.M.

N81-21960# Logistics Management Inst., Washington, D. C.
DEFENSE ENERGY INFORMATION SYSTEM (DEIS): DEIS-80 SYSTEM DESIGN SPECIFICATION Final Report
Joan Lengel Aug. 1980 177 p
(Contract MDA903-77-C-0370)
(AD-A096263; LMI-ML917) Avail: NTIS HC A09/MF A01 CSCL 05/1

The Defense Energy Information System (DEIS) is a worldwide, automated, energy management information system. It provides data on petroleum products used as mobility fuels by the military departments as well as most energy sources used for utility services at DoD installations. DEIS consists of two related information systems. DEIS 1 reports the disposition and consumption of petroleum products, notably aviation gasoline, jet fuels, motor gasoline, distillate and residual oils within DoD. DEIS II reports the consumption of utility energy, such as electricity, natural gas, purchased steam/hot water, fuel oil and coal. It reports the consumption and generation of energy from renewable sources. This document presents the System Design Specification for the enhanced DEIS (DEIS 80). As specified, DEIS 80 improves the utility of the existing system by including additional data, supporting management queries of the DEIS 80 data bases on-line, and providing the capability for automated data analysis. This system design specification serves as the guide for the computer programming of DEIS 80. It adheres to the requirement for system specification in the 'Automated Data Systems Documentation Standards.' GRA

N81-21961# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
RECOVERY OF THE SWALLOW REPOSITORY M.S. Thesis
Gail C. Arens Jan. 1981 123 p refs
(Contract N00014-75-C-0661)
(AD-A096374; MIT/LCS/TR-252) Avail: NTIS HC A02/MF A01 CSCL 09/2

This thesis presents the design of a set of recovery mechanisms for the Swallow repository. Swallow is a distributed data storage system that supports highly reliable long term storage of arbitrary sized data objects with special mechanisms for implementing multi-site atomic actions. The Swallow repository is a data storage server that keeps permanent data in write-once stable storage such as optical disk. The recovery mechanisms provide on-line recovery for the repositor's internal data, as the repository proceeds with its normal operations. In this way, users that wish to access any data that was not affected by the crash can do so while the damaged data is being recovered. Included in the repository's recovery mechanisms are recovery epochs and checkpoint epochs, which facilitate the detection of damage to the data and minimize the amount of recovery that is necessary. Also included are specialized hash table algorithms that are immune to repository failures. In addition to describing these mechanisms, this thesis discusses how they support the global recovery mechanisms of Swallow and analyzes how they will affect the repository's general performance. GRA

N81-21962# Stanford Univ., Calif. Inst. of Communication Research.
INFORMATION AND WORK: RESEARCH ON THE IMPROVEMENT OF PRACTITIONER INFORMATION SYSTEMS Final Report, Oct. 1978 - Mar. 1980
William Paisley, Andrew Hardy, Marilyn Fife, and MaryLou Hadley Oct. 1980 125 p refs
(Grant NSF IST-77-28242)
(PB81-136038) Avail: NTIS HC A06/MF A01 CSCL 05B

A task-performance model of practitioner's work defined the primary tasks that practitioner's information-related work consists of and located task performance within a social framework in which information use is affected by work teams, employing organizations, and formal and informal professional groups. A state of the art practitioner information system, WESTFORNET (Western Forest Information Network), was the focus of data collection. WESTFORNET is used by managers, forestry professionals, engineers, applied scientists, and others working in decenralized and often remote U.S. Forest Service work sites. GRA

N81-21963# McLean Research Center, Inc., Va.
SURVEY OF USER NEEDS FOR COMPUTER FOREIGN AVAILABILITY DATA Final Report
Victoria I. Young, Robert I. Widder, and Donald L. Farrar Aug. 1980 36 p
(PB81-125353; MRC-80-2050; OEA-FA-2) Avail: NTIS HC A03/MF A01 CSCL 05B

Objectives for a foreign availability data base were developed. These include: (1) the establishment and maintenance of a reliable data base; (2) convenient user access; and (3) the ability to handle both quantitative and qualitative information. The specific foreign availability data needs of potential users are found to fall into five general categories: (1) technical specifications; (2) production status; (3) end uses; (4) world wide availability; and (5)comparative assessments. The priority interests of both Congress and the intelligence community are also identified. A brief outline of how the various foreign availability data inputs might be integrated into useful products is included. J.M.S.

N81-21964# McLean Research Center, Inc., Va.
SOURCING AND ORGANIZING THE DATA BASE FOR COMPUTER FOREIGN AVAILABILITY Final Report
Robert I. Widder, Donald L. Farrar, and Victoria I. Young Jul. 1980 74 p
(PB81-125346; MRC-80-2040; OEA-FA-3) Avail: NTIS HC A04/MF A01 CSCL 05B

Knowledgeable U.S. government sources of foreign availability information in the Washington area, the information that they can provide, and transfer mechanisms for access by the Office of Export Administration are examined. Primary data sources for future use are listed. A scheme of organizing OEA's existing foreign availiability information is suggested. Finally, specific mechanisms by which OEA could access the principal information sources are listed. It is found that they will probably be specific to the source organization and the nature of the data request. GRA

N81-21965# General Accounting Office, Washington, D. C. Logistics and Communications Div.
OVERSIGHT OF THE GOVERNMENT'S SECURITY CLASSIFICATION PROGRAM--SOME IMPROVEMENT STILL NEEDED
16 Dec. 1980 65 p
(PB81-138216; LCD-81-13) Avail: NTIS HC A04/MF A01 CSCL 05B

Oversight of the national security information classification program has improved, but some deficiencies in the activity reports submitted by agencies and the Information Security Oversight Office is necessary if the President, the Congress, and the public are to be kept fully informed of the program's status. Some agencies have established procedures that make it difficult for the Oversight Office to obtain all documents needed to effectively inspect agency compliance. This report recommends actions that should improve agency complicance and program oversight are recommended. GRA

N81-21966# Eagle Research Group, Inc., Arlington, Va.
A FOREIGN AVAILABILITY ASSESSMENT PROGRAM FOR THE SEMICONDUCTOR, ELECTRONIC COMPONENTS AND INSTRUMENTATION INDUSTRIES Final Report
29 Aug. 1980 194 p
(PB81-125593; ERG-80-112F1; OEA-FA-4) Avail: NTIS HC A09/MF A01 CSCL 05B

Sections of the Export Adminstration Act of 1979 relating to the foreign availability of technology and technological products are discussed. The industries examined are the semiconductor, electronic components and instrumentation industries. The needs of potential users of foreign availability information, likely sources of that information, and a procedure for sorting and correlating different pieces of data are presented. Specific user needs, and differing perceptions of foreign availability are described in the context of seven specific export control cases. It is concluded that no general data categories can satisfy the disparity of user needs. GRA

N81-21967# Information Technology Council, Canberra (Australia).
TECHNOLOGICAL CHANGE: IMPACT OF INFORMATION TECHNOLOGY 1980
David G. Beanland, William J. Caelli, J. H. Curtis, Lawrence Hartnett, R. J. Hawke, Lenox Hewitt, Barry O. Jones, Peter J. Judge, M. D. Kirby, and Ashley W. Goldsworthy, ed. 1980 148 p refs
(PB81-125494; ISBN-0-642-90091-6) Avail: NTIS HC A07/MF A01 CSCL 05B

One of the fundamental problems facing industrialized society today is the impact of technological change. The underlying technologies that are pushing man at a pace he is barely able to keep up with are computer and communications technologies. These technologies have created a veritable information explosion. Allied to this has been the integration of a broad range of technologies such as printing and photography. It is this whirlpool of technology that presages an explosive growth in the type and volume of information that society will have to handle. The need to recognize the importance of these technologies and their benefits, as well as the problems that will undoubtedly flow from their implementation is presented. GRA

N81-21968# Operations Research, Inc., Silver Spring, Md.
REVIEW OF TECHNOLOGY SHARING DOCUMENT CONTROL Final Report
M. T. Baranano and W. E. Simpson Sep. 1980 52 p
(Contract DTOS59-80-C-00026)
(PB81-125130; ORI-TR-1792; DOT-I-80-31) Avail: NTIS HC A04/MF A01 CSCL 05B

Results of an analytical review of the document control and distribution methods used for technology sharing functions in The Office of the Secretary of Transportation are reported, along

with demonstrations of potential methods for improving document control, and evaluation of potential usage of technology sharing by constituent groups. A specialized Document Control Center was proposed to carry out the centralized control and distribution methods required for effective management of the Technology Sharing Program. Detailed procedures were provided for carrying out the functions of the Document Control Center. GRA

N81-21969# New York Univ., N. Y.
MANUAL OF PRICING AND COST DETERMINATION OF ORGANIZATIONS ENGAGED IN DISSEMINATION OF KNOWLEDGE
William J. Baumol, Yale M. Branunstein, Dietrich M. Fisher, and Janusz A. Ordover 1980 115 p refs
(Grant NSF DSI-74-12785)
(PB81-131856) Avail: NTIS HC A06/MF A01 CSCL 05B

The four major topics of investigation were the structure of supply and demand of information, the Federal Government as the producer and user of information experience in the packaging of information, and the role of technological change. The report examines problems in the production, dissemination and pricing of information, the structure of information industries, and other issues of interest to the information manager, the policy-maker, and researchers in the fields of economics and information science. GRA

N81-21970# EG and G Washington Analytical Services Center, Inc., Rockville, Md. Technology Assessment and Analysis Dept.
FOREIGN AVAILABILITY OF TECHNOLOGY: DEFINITION AND STRUCTURING OF DATA BASE, VOLUME 1 Final Report
Oct. 1980 92 p
(PB81-125049; WASC-TR-S340-0001-F-Vol-1; OEA-FA-1) Avail: NTIS HC A05/MF A01 CSCL 05B

The information needs of potential users (in both the Executive and Legislative branches of the government) for data on the foreign availability of products or technologies are identified. A decision-tree approach that permits the available data to be systematically utilized to the desired degree of specificity to access the availability of equivalent technologies overseas is progressed. Sources of the necessary data are identified and appraised. Data availability is explored systematically in four technical areas: chemicals and materials; transportation; telecommunications; and avionics; navigation and related naval equipment. GRA

N81-21971# EG and G Washington Analytical Services Center, Inc., Rockville, Md. Technology Assessment and Analysis Dept.
FOREIGN AVAILABILITY OF TECHNOLOGY: DEFINITION AND STRUCTURING OF DATA BASE. VOLUME 2: APPENDICES, PART A AND B Final Report
Oct. 1980 306 p refs
(PB81-125056; WASC-TR-S340-0001-A-Vol-2; OEA-FA-1A) Avail: NTIS HC A14/MF A01 CSCL 05B

The requirements and structure of a data base for information on foreign products and technology that are controlled from export from the United States are addressed. It is concluded that adequate data are available to develop a foreign availability data base. The information that was referenced in Volume 1 is appended, including the detailed foreign availability assessments. J.M.S.

N81-21972# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
LEVELS OF OUTPUT RELATED TO COST OF OPERATION OF SCIENTIFIC AND TECHNICAL LIBRARIES, LORCOST, VOLUME 1 Final Report, Jan. 1978 - Jun. 1980
Paul B. Kantor Jun. 1980 110 p refs 3 Vol.
(Grant NSF DSI-77-17776)
(PB81-124703; PBK-80-1A-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 05B

The economic relation between the cost of operating a scientific technical library and the output of that library on service to patrons was explored in the LORCOST Libraries Project. The project combines general descriptive considerations with the definition of new service measures and with detailed mathematical procedures. Descriptive and mathematical materials are presented, libraries, and economic modeling, are discussed. Details of the definition of a best fit, choice of models, and determination of parameters and their errors are covered. An investigation of the problem of pricing library services to maximum social benefit is also discussed. GRA

N81-21973# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
LEVELS OF OUTPUT RELATED TO COST OF OPERATION OF SCIENTIFIC AND TECHNICAL LIBRARIES: LORCOST, VOLUME 2 Final Report
Judy B. Wood and Paul B. Kantor Jun. 1980 66 p 3 Vol.
(Grant NSF DSI-77-17776)
(PB81-124711; PBK-80-1B-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 05B

The possibility of gathering quantitative data on the service rendered by scientific and technical libraries, integrating it into mathematical models of the cost benefit relation, and providing a base for estimation of national levels of activity was explored. Libraries are shown to obey a family of general laws, with economy of scale. Estimates are found of the relative cost of various types of service. The analysis is based upon data collected at and by seventy-three participating libraries, selected from a national frame of five thousand libraries. Detailed formulae, plots, and tables are presented. Several related topics in the availability of reference service and the pricing of library services were also examined. E.A.K.

N81-21974# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
LEVELS OF OUTPUT RELATED TO COST OF OPERATION OF SCIENTIFIC AND TECHNICAL LIBRARIES, LORCOST, VOLUME 3 Final Report, Jan. 1978 - Jun. 1980
Linda Defendeifer and Paul B. Kantor Jun. 1980 192 p 3 Vol.
(Grant NSF DSI-77-17776)
(PB81-124729; PBK-80-1C-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05B

The relationship between services rendered and total operating budget for scientific and technical (Sci-Tech) libraries was studied. The models explored are black box models which do not trace the flow of dollars through the technical services area and to the interface with the clients or patrons of the library. The models are tested by applying them to a sample of approximately 70 Sci-Tech libraries, drawn from a national (U.S.A.) frame of approximately 5,000 such libraries. The frame presented was constructed through a complete scan of the 24,000 libraries summarized in the American Library Directory. E.A.K.

N81-21975# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
SCIENTIFIC AND TECHNICAL PUBLICATIONS OF THE ENVIRONMENTAL RESEARCH LABORATORIES' FISCAL YEAR 1978 Bibliography, 1 Oct. 1977 - 30 Sep. 1978
Jun. 1980 48 p
(PB81-141301; NOAA-80110406) Avail: NTIS HC A03/MF A01 CSCL 05B

Approximately 675 citations in environmental research are presented. Topics covered include: investigation of ocean processes and their interactions with the atmosphere; studies of the ocean environment as it is affected by waste disposal and development of energy resources; fundamental studies of the upper atmosphere and space environments; lower atmosphere research on the weather and climates; research on tsunamis, severe local storms, and hurricanes; studies of weather modification, and the environmental effects of global pollution or similar influences on ecology; and development of equipment, instruments, systems, and facilities for these programs. Publications from research contracts and work done by cooperating institutes, and international aid programs are included. GRA

N81-21976# Commerce Technical Advisory Board, Washington, D.C. International Scientific and Technical Information Issues Group.
CONSIDERATIONS ON INTERNATIONAL FLOW OF SCIENTIFIC AND TECHNOLOGICAL INFORMATION
Vladimir Slamecka Sep. 1980 88 p refs
(PB81-142317) Avail: NTIS HC A05/MF A01 CSCL 05B

The nature of the trade-offs involved in the international

flows of non-military scientific and technological information, both public and proprietary is discussed. The trade-offs include economic variables, social and cultural variables, and reciprocity in the exchange of information. Recommendations are offered for increasing U.S. returns from scientific and technological information and for strengthening the U.S. information service sector. The appendix identifies and briefly discusses a number of mechanisms capable of managing and partly regulating the international flows of scientific and technological information.
GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-21977 International Institute for Applied Systems Analysis, Laxenburg (Austria).
COST ALLOCATION IN WATER RESOURCES DEVELOPMENT. A CASE STUDY OF SWEDEN
H. Peyton Young, Norio Okada, and Tsuyoshi Hashimoto Sep. 1980 45 p refs Prepared in cooperation with Swedish Environmental Protection Board and Lund Univ., Sweden
(IIASA-RR-80-32) Copyright. Avail: Issuing Activity

Approaches to cost allocation are selected for comparison from among the various methods discussed in the project evaluation and game theory literature, and their performance is evaluated by application to an actual municipal cost allocation problem in Sweden. One of the methods used most widely for multipurpose projects, the separable costs/remaining benefits (SCRB) method, suffers from a number of disadvantages, including nonmonotonicity in costs, failure to satisfy group rationality as well as failure to cover marginal costs. A more sophisticated game theory method, the Shapley value, is monotonic and satisfies individual rationality, but may not satisfy group rationality. Three of the remaining methods, the nucleolus, weak nucleolus, and proportional nucleolus methods, always satisfy group rationality and marginal cost coverage when it is possible to do so. However, the nucleolus is not monotonic in costs. The weak nucleolus and proportional nucleolus are both monotonic, but the latter allocates changes in costs in a manner more consistent with the benefits that the participants reap from the enterprise.
Author (ESA)

N81-21978*# Schnittker Associates, Washington, D.C.
IMPACT OF IMPROVED INFORMATION ON THE STRUCTURE OF WORLD GRAIN TRADE
11 Apr. 1979 79 p refs
(Contract NAS5-25187)
(NASA-CR-166654) Avail: NTIS HC A05/MF A01 CSCL 05C

The benefits to be derived by the United States from improvements in global grain crop forecasting capability are discussed. The improvements in forecasting accuracy, which are a result of the use of satellite technology in conjunction with existing ground based estimating procedures are described. The degree of forecasting accuracy to be obtained from satellite technology is also examined. Specific emphasis is placed on wheat production in seven countries/regions: the United States; Canada; Argentina; Australia; Western Europe; the USSR; and all other countries in a group.
R.C.T.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-21979# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
LEAST COST DESIGN OF URBAN DRAINAGE SYSTEMS
Ji Han, A. Ramachandra Rao, and Mark H. Houck Sep. 1980 133 p refs
(Contract DI-14-34-0001-8016)
(PB81-131104; PWRRC-TR-138; OWRT-A-056-IND(2)) Avail: NTIS HC A07/MF A01 CSCL 08H

An urban hydrologic model is developed which gives a least cost design for an urban drainage system. Unlike many such models, the model reported provides for inflow rates estimated by the use of an adequate performing hydrologic model. A simple, readily usable, and theoretically sound model and a dynamic programming subroutine was developed. The model was used to investigate the variation of systems costs with the variation in design parameters and to optimally size the detention storage volume for the least cost of the system.
GRA

N81-21980# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
AN OVERVIEW OF SEVERAL EPA MISFUELING TEST PROGRAMS
Thomas A. Tupaj Oct. 1980 43 p refs
(PB81-136327; EPA-AA-TAB-81-4) Avail: NTIS HC A03/MF A01 CSCL 13F

The rate of catalyst deterioration due to misfueling with leaded gasoline was assessed. Both 'casual' misfueling as well as intentional misfueling were addressed. Recovery of the catalyst upon return to unleaded fuel was also assessed. On the average, one tankful of leaded gasoline was found to triple hydrocarbon (HC) emissions while causing emissions of carbon monoxide (CO) to double. Continued use of leaded gasoline in vehicles designed to meet 1980 Federal Emission Standards resulted in HC and CO emissions increasing to levels which exceeded 1975 Federal Standards. Return to unleaded fuel resulted in recovery of some catalytic activity on slightly poisoned vehicles although continued use of leaded fuel resulted in a permanent loss of catalytic activity.
GRA

N81-21981# Economica, Inc., Tarrytown, N. Y.
URBAN IMPACT METHODOLOGY Final Report
Stanley L. Friedlander Oct. 1980 225 p refs
(Contract EDA-ED-79-SA-00018; Grant EDA-99-7-13473)
(PB81-142614; EDA-ERD-81-004) Avail: NTIS HC A10/MF A01 CSCL 05C

A review of the current literature of urban impact analysis is included. Methodologies for conducting urban impact analysis and a set of recommendations are detailed concerning the appropriateness and feasibility of applying these methodologies in assessing the urban impact of (1) the Long Term Economic Deterioration Program Title IX of the Public Works and Economic Development Act of 1965, as amended, and (2) the proposed National Development Bank.
GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-21982*# California Inst. of Tech., Pasadena.
INFRARED ASTRONOMY Semiannual Status Report, 1 Oct. 1980 - 31 Mar. 1981
G. Neugebauer, B. T. Soifer, and K. Matthews 31 Mar. 1981 22 p
(Grant NGL-05-002-207)
(NASA-CR-164174) Avail: NTIS HC A02/MF A01 CSCL 03A

Several observational programs in infrared astronomy are described and significant findings are briefly discussed. The near infrared work concentrates largely on the use of the 5 m Hale telescope in spectroscopic and photometric studies of extragalactic sources. Observations of the P alpha line profile in a low redshift quasar, X-ray bursters, reflection nebula, and cataclysmic variables are included. Millimeter continuum observations of dust emission from quasars and galactic molecular clouds are also discussed. Finally, improvements to instrumentation are reported. M.G.

N81-21983# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
[RESEARCH ACTIVITIES IN ASTRONOMY AND SPECTROSCOPY, 1979] Annual Report [TAETIGKEITSBERICHT, 1979]
Jan. 1980 105 p refs In GERMAN Original contains color illustrations
(MPI-PAE/Extraterr-160; ISSN-0340-8922) Avail: NTIS HC A06/MF A01

Investigations and projects for the period are reported with emphasis on particle and field measurements in the solar system, including the ionosphere, magnetosphere, and solar wind as well as energetic particle fluxes. Infrared, X-ray, and gamma-ray astronomy are discussed as well as laboratory spectroscopy. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-21984*# National Aeronautics and Space Administration, Washington, D. C.
EVALUATION OF ORBITS WITH INCOMPLETE KNOWLEDGE OF THE MATHEMATICAL EXPECTANCY AND THE MATRIX OF COVARIATION OF ERRORS
B. Ts. Bakhshiyan, R. R. Nazirov, and P. E. Elyasberg Aug. 1980 19 p refs Transl. into ENGLISH of "Otsenki Orbit pri Nepolonom Znanii Mat. Ozhidaniya i Matritsy Kovariatsii Oshibok" Rept. Pr-360 Inst. of Space Research, Academy of Science (USSR), Moscow, 1977 p 1-18
(Contract NASw-3199)
(NASA-TM-76237) Avail: NTIS HC A02/MF A01 CSCL 03B

The problem of selecting the optimal algorithm of filtration and the optimal composition of the measurements is examined assuming that the precise values of the mathematical expectancy and the matrix of covariation of errors are unknown. It is demonstrated that the optimal algorithm of filtration may be utilized for making some parameters more precise (for example, the parameters of the gravitational fields) after preliminary determination of the elements of the orbit by a simpler method of processing (for example, the method of least squares). M.G.

N81-21985*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DEVELOPMENT OF A CCD ARRAY AS AN IMAGING DETECTOR FOR ADVANCED X-RAY ASTROPHYSICS FACILITIES Final Report, 1 Jun. 1979 - 31 Jan. 1981
Daniel A. Schwartz Apr. 1981 59 p refs
(Grant NsG-7615)
(NASA-CR-164169) Avail: NTIS HC A04/MF A01 CSCL 03C

The development of a charge coupled device (CCD) X-ray imager for a large aperture, high angular resolution X-ray telescope is discussed. Existing CCDs were surveyed and three candidate concepts were identified. An electronic camera control and computer interface, including software to drive a Fairchild 211 CCD, is described. In addition a vacuum mounting and cooling system is discussed. Performance data for the various components are given. M.G.

N81-21986# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
REFLECTED AND DIFFUSE IONS BACKSTREAMING FROM THE EARTH'S BOW SHOCK. VOLUME 2: ORIGIN
C. Bonifazi and G. Moreno Jul. 1980 42 p refs Submitted for publication Sponsored by CNR 2 Vol.
(LPS-80-11-Vol-2) Avail: NTIS HC A03/MF A01

The topology of the foreshock region and the origin of the reflected and diffuse ion populations were investigated using statistical analysis of data from the solar wind experiment on the satellite ISEE 2. It is confirmed, on a statistical basis, that quasiperpendicular shock structures generate beams of reflected ions which propagate along the interplanetary magnetic field lines against the incoming solar wind. Diffuse ions most probably originated by the disruption of the reflected beams due to plasma instability, having a growth time on the order of a few tens of seconds. A preliminary energy balance appears consistent with the proposed picture of the phenomena occurring in the foreshock region. Author (ESA)

N81-21987# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
REFLECTED AND DIFFUSE IONS BACKSTREAMING FROM THE EARTH'S BOW SHOCK. VOLUME 1: BASIC PROPERTIES
C. Bonifazi and G. Moreno Aug. 1980 34 p refs Submitted for publication Sponsored by CNR 2 Vol.
(LPS-80-13-Vol-1) Avail: NTIS HC A03/MF A01

Plasma data from the ISEE 2 solar wind experiment were used to perform statistical analysis of the basic moments of the ions backstreaming from the Earth's bow shock. The density and total energy density of the backstreaming ions are, on the average, equal to 1% and 10% of those of the the solar wind, respectively. The distinction between the reflected and diffuse populations is put on a quantitative basis using the ratio R = V sub BP/w sub BP between the bulk velocity and the r.m.s. thermal speed of the ions. The reflected ions move against the incoming solar wind with a bulk velocity equal to twice the solar wind velocity and are characterized by a temperature equal to 7 million K. The diffuse ions have a bulk velocity 1.2 times the solar wind velocity and a temperature of 40 million K. The total energy density of the diffuse ions is 30% larger than that of the reflected ions. While 70% of the total energy density is kinetic for the reflected ions, this percentage decreases to 20% for the diffuse ions. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-21988*# National Aeronautics and Space Administration, Washington, D. C.
THE VIKING SEISMOMETRY Final Report.
Andrew R. Lazarewicz, Don L. Anderson, Kenneth Anderson, Anton M. Daonty, Frederick K. Duennebier, Neal R. Gains, Tony C. D. Knight, Robert L. Kovach, Gary V. Latham, Wayne F. Miller et al Apr. 1981 56 p refs
(Contract NAS7-100)
(NASA-CR-3408) Avail: NTIS HC A04/MF A01 CSCL 03B

Efforts were made to determine the seismicity of Mars as well as define its internal structure by detecting vibrations generated by marsquakes and meteoroid impacts. The lack of marsquakes recognized in the Viking data made it impossible to make any direct inferences about the interior of Mars and only allowed the seting of upper bounds on the seismic activity of the planet. After obtaining more than 2100 hours worth of data during the quite periods at rates of one sample per second or higher, the Viking 2 seismometer was turned off as a consequence of a landing system failure. During the periods when adequate data were obtained, one event of possible seismic or meteoroid impact origin was recognized; however, there is a significant probability that this event was generated by a wind gust. R.C.T.

N81-21989*# Dayton Univ., Ohio.
AN INVESTIGATION OF THE CRATERING-INDUCED MOTIONS OCCURRING DURING THE FORMATION OF BOWL-SHAPED CRATERS Final Technical Report, 1 Jun. 1978 - 30 Jun. 1980
Andrew J. Piekutowski 1980 14 p refs
(Grant NsG-7444)
(NASA-CR-164186) Avail: NTIS HC A02/MF A01 CSCL 03B

The effects of the dynamic processes which occur during crater formation were examined using small hemispherical high-explosive charges detonated in a tank which had one wall constructed of a thick piece of clear plexiglas. Crater formation and the motions of numerous tracer particles installed in the cratering medium at the medium-wall interface were viewed through the wall of this quarter-space tank and recorded with high-speed cameras. Subsequent study and analysis of particle motions and events recorded on the film provide data needed to develop a time-sequence description of the formation of a bowl-shaped crater. Tables show the dimensions of craters produced in a quarter-space tank compared with dimensions of craters produced in normal half-space tanks. Crater growth rate summaries are also tabulated. A.R.H.

N81-21990*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLASMAS IN SATURN'S MAGNETOSPHERE
L. A. Frank, B. G. Burek, K. L. Ackerson, J. H. Wolfe and J. D. Mihalov Apr. 1980 51 p refs Submitted for publication Prepared in cooperation with Iowa Univ., Iowa City
(Grant NGL-16-001-002)
(NASA-TM-82345; AD-A096079; U-of Iowa-80-12) Avail: NTIS HC A04/MF A01 CSCL 03/2

The solar wind plasma analyzer on board Pioneer 2 provides first observations of low-energy positive ions in the magnetosphere of Saturn. Measurable intensities of ions within the energy-per-unit charge (E/Q) range 100 eV to 8 keV are present over the planetocentric radial distance range about 4 to 16 R sub S in the dayside magnetosphere. The plasmas are found to be rigidly corotating with the planet out to distances of at least 10 R sub S. At radial distances beyond 10 R sub S, the bulk flows appear to be in the corotation direction but with lesser speeds than those expected from rigid corotation. At radial distances beyond the orbit of Rhea at 8.8 R sub S, the dominant ions are most likely protons and the corresponding typical densities and temperatures are 0.5/cu cm and 1,000,000 K, respectively, with substantial fluctuations. It is concluded that the most likely source of these plasmas in the photodissociation of water frost on the surface of the ring material with subsequent ionization of the products and radially outward diffusion. The presence of this plasma torus is expected to have a large influence on the dynamics of Saturn's magnetosphere since the pressure ratio beta of these plasmas approaches unity at radial distances as close to the planet as 6.5 R sub S. On the basis of these observational evidences it is anticipated that quasi-periodic outward flows of plasma, accompanied with a reconfiguration of the magnetosphere beyond about 6.5 R sub S, will occur in the local night sector in order to relieve the plasma pressure from accretion of plasma from the rings. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-21991*# California State Univ., Northridge.
CONTINUED ANALYSIS OF OSO-8 AND KITT PEAK DATA ON SOLAR FACULAE Final Technical Report, 1 Jun. 1978 - 30 Nov. 1979
G. A. Chapman Apr. 1981 125 p refs
(Grant NsG-7456)
(NASA-CR-164141) Avail: NTIS HC A06/MF A01 CSCL 03B

An improved semi-empirical model of phosphoric faculae is presented in tabular form. The limitations of the model as well as other possible improvements are discussed. R.C.T.

N81-21992# Brookhaven National Lab., Upton, N. Y.
SOLAR NEUTRINO EXPERIMENTS AND A TEST FOR NEUTRINO OSCILLATIONS WITH RADIOACTIVE SOURCES
Bruce T. Cleveland, Raymond Davis, Jr., and J. K. Rowley 1980 12 p refs Presented at the Neutrino Mass Mini-Conf., Cable, Wis., 1 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28654; CONF-8010127-6) Avail: NTIS HC A02/MF A01

The results of the solar neutrino experiment are given and compared to the most recent standard solar model calculations. The observations are about a factor of 4 below theoretical expectations. In view of the uncertainties involved in the theoretical models of the Sun, the discrepancy is not considered to be evidence for neutrino oscillations. The status of the development of a gallium solar neutrino detector is described. Radiochemical neutrino detectors can be used to search for electron neutrinos oscillations by using megacurie sources of monoenergetic neutrinos like Zn-65. A quantitative evaluation of possible experiments using the chlorine solar neutrino detector and a gallium detector is given. DOE

N81-21993# Ruhr Univ., Bochum (West Germany). Bereich Extraterrestrische Physik.
TEMPERATURE DISTRIBUTION AND DYNAMICS OF INTERPLANETARY DUST PARTICLES IN THE VICINITY OF THE SUN (SOLAR PROBE HELIOS A AND B: EXPERIMENT 10 Z) Final Report
Gerhard H. Schewhm Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 109 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-79-40; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

The sublimation of interplanetary dust grains in the vicinity of the Sun was considered, especially as a possible source of beta meteoroids. Data from the HELIOS 1 and 2 micrometeoroid detectors (E 10) were interpreted. To determine the sublimation rates, the energy balance of a grain was evaluated for interaction with the solar radiation field, with solar wind particles, and with solar energetic particles. Compared to the energy transfered through interaction with the solar radiation field, all other processes were negligible for the determination of the temperature distribution. The only exception was water ice particles. The equation of motion for the dust particles was numerically solved with regard to the forces of interaction with the solar electromagnetic radiation field. Depending on the material and sizes, the orbits of the particles stabilize at different heliocentric distances. The inward spiraling due to the Poynting-Robertson effect ends by the total evaporation of the particles in the stability region. Author (ESA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N81-21994* National Aeronautics and Space Administration, Washington, D. C.

SIGNIFICANT NASA INVENTIONS. AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES

1981 136 p

(NASA-SP-7038(06)) Avail: SOD HC $4.25 CSCL 05B

Inventions are arranged by subject matter which includes: aeronautics; space flight and satellites; chemistry, polymers and materials, electrical, electronics and computer; fluid mechanics and heat transfer; instrumentation; energy, including solar; medical and life science; photography and optics; mechanical engineering, testing and metal forming; and lasers and masers. S.F.

N81-21995*# National Aeronautics and Space Administration, Washington, D. C.

A CATALOG OF NASA SPECIAL PUBLICATIONS

1981 110 p

(NASA-SP-449) Avail: NTIS HC A06/MF A01 CSCL 05B

A list of all of the special publications released by NASA are presented. The list includes scientific and technical books covering a wide variety of topics, including much of the agencies research and development work, its full range of space exploration programs, its work in advancing aeronautics technology, and many associated historical and managerial efforts. A total of 1200 titles are presented. R.C.T.

N81-21996# Ecole Nationale Superieure de Techniques Avancees, Paris (France).

ACTIVITIES REPORT ON RESEARCH IN OPTICS, MECHANICS, CHEMISTRY AND COMPUTER SCIENCE, 1979 Annual Report [RAPPORT D'ACTIVITE SUR LES RECHERCHES A L'ECOLE NATIONALE SUPERIEURE DE TECHNIQUES AVANCEES]

1980 102 p refs In FRENCH Original contains color illustrations

Avail: NTIS HC A06/MF A01

The aims of this technical institute are presented together with the functions of the various different departments. The activities are developed in relation with industry, other technical institutes and large national organizations. Courses, research activities and relations with industry exist in the following fields: chemistry, hydrothermodynamics, computer science, materials and structures, optics and related fields. Author (ESA)

N81-21997# National Bureau of Standards, Washington, D.C.

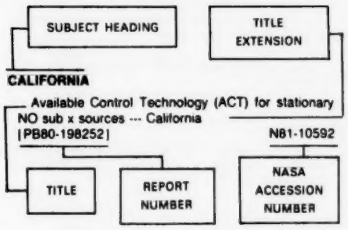
JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS. VOLUME 85, NUMBER 5 Bimonthly Report, Sep. - Oct. 1980

1980 92 p refs

(PB81-138356; LC-63-37059) Avail: NTIS HC A05/MF A01 CSCL 05B

Contents include: a simple gravimetric method to determine barometer corrections; investigation of epitaxy relationships between Ca5(PO4)3OH and other calcium orthophosphates; a univariate extension of Jensen's inequality; the numerical solution of a nonseparable elliptic partial differential equation by preconditioned conjugate gradients; and player aggregation in noncooperative games. GRA

Typical Subject Index Listing



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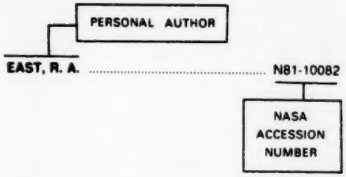

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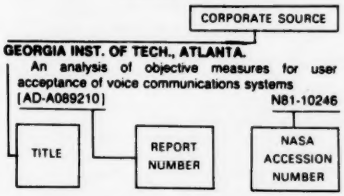

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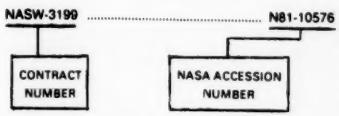

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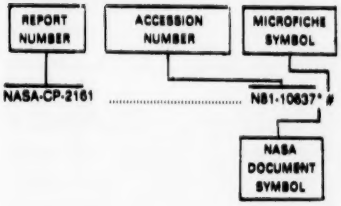

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ARB-R-80/131 ..... N81-21653 #

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ARO-14380.1-MS ..... N81-21380 #
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CE-STR-80-6 ..... N81-21405 #

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CNES-79/CT/PRT/SST/SS/014 ..... N81-21368 #
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DFVLR-FB-79-17 ..... N81-21369 #
DFVLR-FB-79-33 ..... N81-21764 #
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DFVLR-MITT-79-08 ..... N81-21057 #
DFVLR-MITT-79-09 ..... N81-21041 #
DFVLR-MITT-79-12 ..... N81-21716 #
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DOE/BP-15325-T8 ..... N81-21219 #

DOE/CH-93003-5 ..... N81-21669 #

DOE/CS-31522/T1 ..... N81-21603 #
DOE/CS-32224/T1 ..... N81-21566 #

DOE/DF-81-005C ..... N81-21786 #

DOE/EDP-0044 ..... N81-21641 #

DOE/EIA-0206/78 ..... N81-21610 #

DOE/ER-0089 ..... N81-21613 #
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DOE/ER-0096 ..... N81-21642 #
DOE/ER-01198-1337 ..... N81-21184 #
DOE/ER-01198-1338 ..... N81-21180 #
DOE/ER-01198-1340 ..... N81-21938 #
DOE/ER-02232/T1 ..... N81-21896 #
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DOE/ET-27127/1 ..... N81-21646 #
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DOE/NASA/0067-79/2 ..... N81-21547* #
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DOE/RL-01830/T3 ..... N81-21619 #

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DOE/TIC-11207(DRAFT) ..... N81-21891 #
DOE/TIC-11373 ..... N81-21359 #
DOE/TIC-11389 ..... N81-21611 #

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EGG-FSP-5238 ..... N81-21924 #

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EPA-AA-TEB-81-1 ..... N81-21371 #

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EPA-600/2-80-068 ..... N81-21165 #
EPA-600/2-80-094 ..... N81-21484 #
EPA-600/2-80-194 ..... N81-21656 #
EPA-600/2-80-196 ..... N81-21163 #
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NASA-TM-81964 ..... N81-21132* #
NASA-TM-81966 ..... N81-21951* #
NASA-TM-81971 ..... N81-21904* #
NASA-TM-82018 ..... N81-21428* #
NASA-TM-82020 ..... N81-21441* #
NASA-TM-82314 ..... N81-21949* #
NASA-TM-82322 ..... N81-21417* #
NASA-TM-82323 ..... N81-21429* #
NASA-TM-82326 ..... N81-21702* #
NASA-TM-82329 ..... N81-21769* #
NASA-TM-82404 ..... N81-21172* #
NASA-TM-82406 ..... N81-21280* #
NASA-TM-82409 ..... N81-21171* #

NASA-TP-1788-VOL-1 ..... N81-21686* #
NASA-TP-1788-VOL-2 ..... N81-21693* #
NASA-TP-1802 ..... N81-21116* #
NASA-TP-1806 ..... N81-21077* #
NASA-TP-1807 ..... N81-21685* #
NASA-TP-1812 ..... N81-21193* #
NASA-TP-1819 ..... N81-21775* #
NASA-TP-1820 ..... N81-21016* #
NASA-TP-1833 ..... N81-21873* #

NAVAIR-518-1 ..... N81-21069 #

NBS-SP-500-71 ..... N81-21787 #

NBSIR-80-2162 ..... N81-21373 #
NBSIR-80-2167 ..... N81-21249 #

NCS-TIB-81-1 ..... N81-21804 #

NCSC-TM-298-80 ..... N81-21549 #

NEAR-TR-160 ..... N81-21019* #

NGS-19 ..... N81-21478 #

NLR-MP-79020-U ..... N81-21038 #
NLR-MP-79046-U ..... N81-21844 #
NLR-MP-80001-U ..... N81-21400 #
NLR-MP-80006-U ..... N81-21401 #
NLR-MP-80009-U ..... N81-21801 #
NLR-MP-80010-U ..... N81-21042 #

NLR-TR-79056-U ..... N81-21391 #
NLR-TR-79124-U ..... N81-21392 #
NLR-TR-80012-U ..... N81-21140 #

NOAA-TM-EDIS-NCC-4 ..... N81-21718 #

NOAA-TM-ERL-ARL-89 ..... N81-21680 #

NOAA-TM-ERL-GLERL-29 ..... N81-21723 #
NOAA-TM-ERL-GLERL-31 ..... N81-21721 #
NOAA-TM-ERL-GLERL-32 ..... N81-21479 #

NOAA-TM-ERL-PMEL-20 ..... N81-21720 #

NOAA-TM-ERL-PROFS-2 ..... N81-21722 #

NOAA-TM-ERL-WPL-61 ..... N81-21727 #
NOAA-TM-ERL-WPL-62 ..... N81-21728 #
NOAA-TM-ERL-WPL-64 ..... N81-21717 #

NOAA-TR-ERL-ARL-90 ..... N81-21719 #

NOAA-TR-NOS-88 ..... N81-21478 #

NOAA-80102101 ..... N81-21478 #
NOAA-80110403 ..... N81-21723 #
NOAA-80110404 ..... N81-21680 #
NOAA-80110405 ..... N81-21722 #
NOAA-80110406 ..... N81-21975 #
NOAA-80111001 ..... N81-21720 #
NOAA-80111004 ..... N81-21727 #
NOAA-80111005 ..... N81-21728 #
NOAA-80111402 ..... N81-21682 #
NOAA-80112801 ..... N81-21717 #
NOAA-80112802 ..... N81-21719 #
NOAA-80112803 ..... N81-21721 #
NOAA-80120308 ..... N81-21718 #

NOR-80-138 ..... N81-21009* #

NOSC/TD-400 ..... N81-21265 #

NOSC/TR-647 ..... N81-21266 #

NPL-DMA(A)-13 ..... N81-21188 #

NPS54-79-019 ..... N81-21067 #
NPS67-80-007 ..... N81-21324 #
NPS67-81-001 ..... N81-21945 #

NRL-MR-4344 ..... N81-21662 #
NRL-MR-4414 ..... N81-21841 #
NRL-MR-4436 ..... N81-21917 #
NRL-MR-4460 ..... N81-21292 #
NRL-MR-4462 ..... N81-21881 #
NRL-MR-4469 ..... N81-21894 #
NRL-MR-4480 ..... N81-21795 #

NR80H-102-VOL-1 ..... N81-21017* #
NR80H-102-VOL-2 ..... N81-21018* #

NSF/RA-800186 ..... N81-21370 #
NSF/RA-800193 ..... N81-21243 #
NSF/RA-800194 ..... N81-21250 #
NSF/RA-800195 ..... N81-21242 #
NSF/RA-800206 ..... N81-21405 #
NSF/RA-800217 ..... N81-21402 #
NSF/RA-800226 ..... N81-21829 #
NSF/RA-800264 ..... N81-21633 #
NSF/RA-800283 ..... N81-21407 #
NSF/RA-800305 ..... N81-21683 #
NSF/RA-800321 ..... N81-21191 #

NSS-SFDS-LR013 ..... N81-21094* #
NSS-SFDS-LR022 ..... N81-21090* #
NSS-SFDS-LR028 ..... N81-21091* #
NSS-SFDS-LR040 ..... N81-21092* #
NSS-SFDS-LR069 ..... N81-21093* #

NSWC/TR-80-330 ..... N81-21108 #

NSWC/WOL/TR-77-134 ..... N81-21861 #

NT-1980-2 ..... N81-21399 #

NWSC/CR/RDTR-1 ..... N81-21177 #

NWSC/CR/TR/6042/C80/04 ..... N81-21297 #

NYSERDA-80-5 ..... N81-21237 #
NYSERDA-80-7 ..... N81-21632 #
NYSERDA-80-16 ..... N81-21634 #

OEA-FA-1 ..... N81-21970 #
OEA-FA-1A ..... N81-21971 #
OEA-FA-2 ..... N81-21963 #
OEA-FA-3 ..... N81-21964 #
OEA-FA-4 ..... N81-21966 #

ONERA-NT-1979-5 ..... N81-21340 #
ONERA-NT-1979-8 ..... N81-21046 #
ONERA-NT-1980-3 ..... N81-21913 #

ONR-2-3 ..... N81-21200 #

ORI-TR-1792 ..... N81-21968 #

ORNL-TR-4703 ..... N81-21888 #

ORNL-5656 ..... N81-21467 #
ORNL-5661 ..... N81-21606 #
ORNL-5664 ..... N81-21223 #

ORNL/CSD/TM-144 ..... N81-21326 #

ORNL/EIS-151 ..... N81-21762 #
ORNL/EIS-189 ..... N81-21763 #

ORNL/TM-6495 ..... N81-21638 #
ORNL/TM-7513 ..... N81-21179 #
ORNL/TM-7618 ..... N81-21181 #

ORO-4935-042 ..... N81-21901 #
ORO-5866-11 ..... N81-21884 #

OTA-C-78-339 ..... N81-21234 #

OTA-E-128 ..... N81-21233 #

OUEL-1308/80 ..... N81-21393 #
OUEL-1312/80-PT-1 ..... N81-21330 #
OUEL-1313/80-PT-2 ..... N81-21331 #
OUEL-1317/80 ..... N81-21394 #
OUEL-1319/80 ..... N81-21395 #
OUEL-1323/80 ..... N81-21821 #

OWRT-A-038-WVA(1) ..... N81-21482 #
OWRT-A-047-TENN(1) ..... N81-21486 #
OWRT-A-055-OH10(1) ..... N81-21481 #
OWRT-A-056-IND(1) ..... N81-21476 #
OWRT-A-056-IND(2) ..... N81-21979 #
OWRT-A-109-MICH(1) ..... N81-21483 #
OWRT-A-111-MO(1) ..... N81-21487 #

OWRT-B-045-NEV(1) ..... N81-21480 #
OWRT-B-094-IND(5) ..... N81-21485 #
OWRT-B-119-SC(1) ..... N81-21652 #

OWRT-C-80294-S(8521)(1) ..... N81-21169 #
OWRT-C-80316-S(8538)(1) ..... N81-21166 #
OWRT-C-80364-S(9462)(1) ..... N81-21164 #
OWRT-C-90009-T(0415)(1) ..... N81-21648 #
OWRT-C-90028-D(9407)(1) ..... N81-21170 #
OWRT-C-90176-D(9515)(1) ..... N81-21168 #

PAR-80-57 ..... N81-21260 #

PBK-80-1A-VOL-1 ..... N81-21972 #
PBK-80-1B-VOL-2 ..... N81-21973 #
PBK-80-1C-VOL-3 ..... N81-21974 #

PB81-120008 ..... N81-21650 #
PB81-120792 ..... N81-21679 #
PB81-120818 ..... N81-21654 #
PB81-122319 ..... N81-21242 #
PB81-122327 ..... N81-21243 #
PB81-122335 ..... N81-21250 #
PB81-123275 ..... N81-21402 #
PB81-124489 ..... N81-21471 #
PB81-124497 ..... N81-21477 #
PB81-124703 ..... N81-21972 #
PB81-124711 ..... N81-21973 #
PB81-124729 ..... N81-21974 #
PB81-125049 ..... N81-21970 #
PB81-125056 ..... N81-21971 #
PB81-125130 ..... N81-21968 #
PB81-125346 ..... N81-21964 #
PB81-125353 ..... N81-21963 #
PB81-125494 ..... N81-21967 #
PB81-125593 ..... N81-21966 #
PB81-126377 ..... N81-21656 #
PB81-126526 ..... N81-21652 #
PB81-126765 ..... N81-21472 #
PB81-127573 ..... N81-21649 #
PB81-127813 ..... N81-21163 #
PB81-128068 ..... N81-21278 #
PB81-128100 ..... N81-21241 #
PB81-129223 ..... N81-21244 #
PB81-130023 ..... N81-21240 #
PB81-130148 ..... N81-21786 #
PB81-131096 ..... N81-21476 #
PB81-131104 ..... N81-21979 #
PB81-131112 ..... N81-21480 #
PB81-131138 ..... N81-21648 #
PB81-131468 ..... N81-21166 #
PB81-131856 ..... N81-21969 #
PB81-132078 ..... N81-21829 #
PB81-132292 ..... N81-21246 #
PB81-132458 ..... N81-21247 #
PB81-132466 ..... N81-21373 #
PB81-132532 ..... N81-21248 #
PB81-132813 ..... N81-21680 #
PB81-132896 ..... N81-21473 #
PB81-132953 ..... N81-21629 #
PB81-133050 ..... N81-21478 #
PB81-133399 ..... N81-21371 #
PB81-133407 ..... N81-21727 #
PB81-133720 ..... N81-21659 #
PB81-133829 ..... N81-21249 #
PB81-134496 ..... N81-21631 #
PB81-134512 ..... N81-21718 #
PB81-134520 ..... N81-21479 #
PB81-134561 ..... N81-21481 #
PB81-134769 ..... N81-21233 #
PB81-134777 ..... N81-21234 #
PB81-134785 ..... N81-21235 #
PB81-134793 ..... N81-21236 #
PB81-134926 ..... N81-21164 #
PB81-135196 ..... N81-21719 #
PB81-135360 ..... N81-21167 #
PB81-135956 ..... N81-21232 #
PB81-135980 ..... N81-21655 #
PB81-135998 ..... N81-21475 #
PB81-136012 ..... N81-21406 #
PB81-136020 ..... N81-21245 #
PB81-136038 ..... N81-21962 #
PB81-136145 ..... N81-21474 #
PB81-136186 ..... N81-21165 #
PB81-136236 ..... N81-21403 #
PB81-136319 ..... N81-21408 #
PB81-136327 ..... N81-21980 #
PB81-136459 ..... N81-21651 #
PB81-137697 ..... N81-21653 #
PB81-137721 ..... N81-21787 #
PB81-137846 ..... N81-21370 #
PB81-138000 ..... N81-21482 #
PB81-138216 ..... N81-21965 #
PB81-138356 ..... N81-21997 #
PB81-138422 ..... N81-21630 #
PB81-139693 ..... N81-21914 #
PB81-140121 ..... N81-21191 #
PB81-140139 ..... N81-21404 #
PB81-140501 ..... N81-21405 #
PB81-140675 ..... N81-21632 #
PB81-140691 ..... N81-21407 #
PB81-140824 ..... N81-21633 #
PB81-140949 ..... N81-21681 #
PB81-141020 ..... N81-21728 #
PB81-141038 ..... N81-21720 #
PB81-141046 ..... N81-21717 #
PB81-141053 ..... N81-21721 #
PB81-141061 ..... N81-21722 #
PB81-141079 ..... N81-21723 #
PB81-141301 ..... N81-21975 #
PB81-141467 ..... N81-21634 #

PB81-141517 ..... N81-21682 #
PB81-141574 ..... N81-21657 #
PB81-141921 ..... N81-21237 #
PB81-142184 ..... N81-21635 #
PB81-142226 ..... N81-21483 #
PB81-142242 ..... N81-21168 #
PB81-142317 ..... N81-21976 #
PB81-142473 ..... N81-21484 #
PB81-142614 ..... N81-21981 #
PB81-143356 ..... N81-21485 #
PB81-143380 ..... N81-21486 #
PB81-143398 ..... N81-21487 #
PB81-144073 ..... N81-21488 #
PB81-144503 ..... N81-21683 #
PB81-145187 ..... N81-21658 #
PB81-147787 ..... N81-21169 #
PB81-150237 ..... N81-21170 #

PML-1979-009 ..... N81-21647 #

PNL-SA-8696 ..... N81-21624 #

PNL-3195-VOL-5 ..... N81-21712 #
PNL-3518 ..... N81-21900 #
PNL-3533-VOL-1 ..... N81-21605 #
PNL-3581 ..... N81-21587 #
PNL-3641 ..... N81-21182 #
PNL-3694 ..... N81-21224 #
PNL-3695-APP-B ..... N81-21604 #

PNR-90038 ..... N81-21114 #
PNR-90043 ..... N81-21037 #

POLY-M/AE-80-32 ..... N81-21034 #

PPPL-1721 ..... N81-21185 #
PPPL-1725 ..... N81-21186 #

PR-2 ..... N81-21682 #
PR-3 ..... N81-21423* #
PR-3712-11 ..... N81-21422* #

PRI-15 ..... N81-21926 #
PRI-19 ..... N81-21922 #

PSI-TR-205 ..... N81-21123* #
PSI-TR-220 ..... N81-21124* #
PSI-TR-244 ..... N81-21319 #

PUB-41066 ..... N81-21480 #

PWRRC-TR-135 ..... N81-21476 #
PWRRC-TR-138 ..... N81-21979 #

P81-10035 ..... N81-21104*

QPR-2 ..... N81-21094* #
QPR-3 ..... N81-21090* #
QPR-4 ..... N81-21091* #
QPR-4 ..... N81-21540* #
QPR-5 ..... N81-21092* #
QPR-5 ..... N81-21543* #
QPR-6 ..... N81-21093* #
QPR-10 ..... N81-21095* #
QPR-17 ..... N81-21942 #

QR-1 ..... N81-21414* #
QR-1 ..... N81-21542* #
QR-1 ..... N81-21934 #
QR-4 ..... N81-21430* #
QR-4 ..... N81-21544* #
QR-5 ..... N81-21547* #
QR-5 ..... N81-21910 #
QR-6 ..... N81-21536* #
QR-6 ..... N81-21548* #
QR-8 ..... N81-21183 #
QR-13 ..... N81-21410* #

QSTPR-1 ..... N81-21421* #
QSTPR-5 ..... N81-21413* #

RADC-TR-80-274 ..... N81-21784 #
RADC-TR-80-288 ..... N81-21294 #
RADC-TR-80-362 ..... N81-21256 #
RADC-TR-80-365 ..... N81-21260 #
RADC-TR-80-372 ..... N81-21263 #
RADC-TR-80-373 ..... N81-21252 #
RADC-TR-80-379-VOL-1 ..... N81-21789 #
RADC-TR-80-379-VOL-2 ..... N81-21811 #
RADC-TR-80-379-VOL-3 ..... N81-21812 #

RADC-TR-80-384 ..... N81-21289 #
RADC-TR-80-387 ..... N81-21461 #
RADC-TR-80-389 ..... N81-21064 #
RADC-TR-80-390 ..... N81-21296 #
RADC-TR-80-392 ..... N81-21261 #
RADC-TR-80-398 ..... N81-21933 #
RADC-TR-80-401-PT-1 ..... N81-21783 #
RADC-TR-80-401-PT-2 ..... N81-21782 #

RAE-TM-RAD-NAV-135 ..... N81-21269 #

REPT-A-8320 ..... N81-21440* #

REPT-D-6137 ..... N81-21192* #

REPT-2-53020/OR-52578 ..... N81-21106* #
REPT-7 ..... N81-21649 #
REPT-9 ..... N81-21829 #
REPT-03-80-2 ..... N81-21667 #
REPT-21-3668 ..... N81-21080 #
REPT-28 ..... N81-21948* #
REPT-30 ..... N81-21439* #
REPT-44-3271 ..... N81-21802 #
REPT-76 ..... N81-21416* #
REPT-80-1 ..... N81-21725 #
REPT-80-1.2 ..... N81-21434* #
REPT-80-9D3-TINAV-R1 ..... N81-21385 #
REPT-80-123 ..... N81-21927 #
REPT-80-126 ..... N81-21928 #
REPT-178 ..... N81-21429* #
REPT-402-DT-2 ..... N81-21120 #
REPT-807 ..... N81-21238 #
REPT-1758-01-2-2360 ..... N81-21707 #
REPT-1758-01-3-2361 ..... N81-21708 #
REPT-2305 ..... N81-21334 #
REPT-3622-4 ..... N81-21446* #
REPT-4215 ..... N81-21871* #
REPT-6410 ..... N81-21252 #
REPT-7165 ..... N81-21279* #
REPT-32999-F-E1 ..... N81-21126* #
REPT-78004-01 ..... N81-21906* #

RF-760851-710797 ..... N81-21481 #

RI/RD80-237 ..... N81-21125* #

RISOE-M-2146 ..... N81-21626 #

RPA-RA-80-0429(2) ..... N81-21631 #

RR-CE-13 ..... N81-21403 #
RR-CE-14 ..... N81-21245 #
RR-CE-15 ..... N81-21406 #
RR-CE-16 ..... N81-21408 #

RR-80-8 ..... N81-21239 #
RR-81-02 ..... N81-21849 #

RSC-3697-6 ..... N81-21130* #
RSC-3697-6 ..... N81-21445* #

RSRE-MEMO-3272 ..... N81-21800 #
RSRE-MEMO-3281 ..... N81-21809 #

RTI/1680/00 ..... N81-21656 #

R81-9955343-9-VOL-1 ..... N81-21538* #
R81-9955343-9-VOL-2 ..... N81-21539* #

SAI-80-154-DEN ..... N81-21796 #
SAI-254-80-594-LJ ..... N81-21926 #
SAI-254-80-650-LJ ..... N81-21922 #

SAN-1422-1 ..... N81-21625 #

SAND-79-7055/2 ..... N81-21574 #
SAND-80-0102 ..... N81-21620 #
SAND-80-0968 ..... N81-21925 #
SAND-80-1323 ..... N81-21468 #
SAND-80-1348 ..... N81-21300 #
SAND-80-1395 ..... N81-21299 #
SAND-80-1654 ..... N81-21947 #
SAND-80-1964/3 ..... N81-21568 #
SAND-80-1970 ..... N81-21672 #
SAND-80-2126 ..... N81-21226 #
SAND-80-2151 ..... N81-21231 #
SAND-80-2371 ..... N81-21842 #
SAND-80-2373 ..... N81-21571 #
SAND-80-2407 ..... N81-21569 #
SAND-80-2409 ..... N81-21621 #

SAND-80-2514 ..... N81-21138 #
SAND-80-2691 ..... N81-21367 #
SAND-80-7063 ..... N81-21601 #
SAND-80-7137 ..... N81-21912 #
SAND-80-7143 ..... N81-21733 #
SAND-80-7148 ..... N81-21575 #
SAND-80-7150 ..... N81-21209 #
SAND-80-7167 ..... N81-21570 #
SAND-80-8234 ..... N81-21622 #
SAND-80-8240 ..... N81-21325 #
SAND-80-8248 ..... N81-21617 #
SAND-81-0218C ..... N81-21352 #

SASR-1 ..... N81-21438* #
SASR-3 ..... N81-21211* #
SASR-3 ..... N81-21447* #
SASR-6 ..... N81-21447* #

SD-TR-81-6 ..... N81-21146 #
SD-TR-81-8 ..... N81-21107 #

SDAC-TR-79-4 ..... N81-21663 #
SDAC-TR-80-2 ..... N81-21664 #

SE-24 ..... N81-21682 #
SE-25 ..... N81-21681 #

SER-C-255 ..... N81-21056 #
SER-C-258 ..... N81-21673 #

SER-510039 ..... N81-21035 #

SERI/PR-0-8254-F ..... N81-21591 #

SERI/SP-763-718 ..... N81-21576 #

SERI/TR-631-716 ..... N81-21579 #
SERI/TR-721-960 ..... N81-21711 #
SERI/TR-733-790-VOL-1 ..... N81-21618 #
SERI/TR-742-654 ..... N81-21577 #
SERI/TR-751-749 ..... N81-21578 #

SF29 ..... N81-21286 #

SOL-77-9 ..... N81-21794 #
SOL-80-3R ..... N81-21793 #
SOL-80-14 ..... N81-21794 #
SOL-80-15 ..... N81-21794 #
SOL-80-28 ..... N81-21792 #
SOL-80-29 ..... N81-21791 #

SOLAR/0010-81/01 ..... N81-21710 #
SOLAR/0024-80/41 ..... N81-21556 #
SOLAR/1001-80/14 ..... N81-21552 #
SOLAR/1014-80/14 ..... N81-21557 #
SOLAR/1043-80/14 ..... N81-21553 #
SOLAR/2015-80/14 ..... N81-21554 #
SOLAR/2029-80/14 ..... N81-21555 #

SR-HO-00492 ..... N81-21416* #

SSD-80-0108-2 ..... N81-21491* #
SSD-80-0108-6-2 ..... N81-21492* #
SSD-80-0120 ..... N81-21534* #

SSG-80-0005 ..... N81-21133* #

STR-5 ..... N81-21667 #

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STU-79-6394 ..... N81-21551 #

SU-JIAA-TR-26 ..... N81-21014* #
SU-JIAA-TR-27 ..... N81-21872* #
SU-JIAA-TR-32 ..... N81-21015* #
SU-JIAA-TR-33 ..... N81-21309* #

SU-STAN-CS-80-825 ..... N81-21838 #
SU-STAN-CS-80-826 ..... N81-21290 #

TAEG-TN-1-81 ..... N81-21797 #

TDCK-71761 ..... N81-21647 #

TI-08-80-32 ..... N81-21296 #

TL-632131 ..... N81-21475 #
TL-632166 ..... N81-21241 #
TL-633133 ..... N81-21246 #

TL-635350 ..... N81-21240 #

TM-9 ..... N81-21675 #

TPR-2 ..... N81-21602 #

TR-EE80-51 ..... N81-21779 #

TR-3 ..... N81-21320 #
TR-3 ..... N81-21879 #
TR-5 ..... N81-21202 #
TR-6 ..... N81-21203 #
TR-7 ..... N81-21194 #
TR-7 ..... N81-21204 #
TR-8 ..... N81-21201 #
TR-10 ..... N81-21348 #
TR-11 ..... N81-21349 #
TR-13 ..... N81-21151 #
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